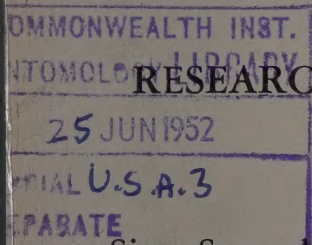


EXD



# RESEARCH ON MAINE FARM PROBLEMS

Sixty-Seventh Annual Report of Progress  
Year Ending June 30, 1951

THE MAINE AGRICULTURAL EXPERIMENT STATION  
UNIVERSITY OF MAINE  
ORONO, MAINE

Experimental Poultry Plant at Orono Provides Research Facilities for Breeding  
and Feeding Tests for Broilers, Flock Replacements, and Laying Flock.



# UNIVERSITY OF MAINE

## MAINE AGRICULTURAL EXPERIMENT STATION

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C. H. Merchant<sup>3</sup>.....(Head) Agr. Econ.  
 H. B. Metzger<sup>3</sup>.....Assoc. Agr. Econ.  
 A. L. Perry<sup>3</sup>.....Asst. Agr. Econ.  
 W. E. Pullen<sup>1,3</sup>.....Act. Asst. in Agr. Econ.  
 W. E. Savage.....Asst. in Agr. Econ.  
 W. E. Schrumpf.....Asst. Agr. Econ.  
 B. C. Thomson<sup>1,3</sup>.....Act. Asst. in Agr. Econ.  
 H. C. Woodward.....Asst. Agr. Econ.

#### AGRICULTURAL ENGINEERING

F. W. Peikert<sup>3</sup>.....(Head) Agr. Eng.  
 H. D. Bartlett<sup>3</sup>.....Asst. in Agr. Eng.  
 R. B. Hopkins.....Asst. Agr. Eng.  
 F. W. Roth<sup>1,3</sup>.....Asst. Agr. Eng.

#### AGRONOMY

W. C. Libby<sup>2,3</sup>.....(Head) Agron.  
 R. A. Struchtemeyer<sup>3</sup>.....(Acting Head)  
 Assoc. Agron.  
 P. N. Carpenter.....Asst. Agron.  
 C. E. Cunningham<sup>3</sup>.....Asst. in Agron.  
 S. C. Jenkins.....Asst. in Agron.  
 C. H. Moran<sup>3,4</sup>.....Assoc. Agron.  
 H. J. Murphy<sup>3</sup>.....Asst. Agron.  
 L. H. Taylor<sup>1,3</sup>.....Asst. Agron.  
 G. L. Terman<sup>3</sup>.....Agron.  
 H. W. Trask.....Asst. in Agron.  
 M. F. Trevett<sup>3</sup>.....Assoc. Agron.

#### ANIMAL INDUSTRY

H. C. Dickey<sup>2</sup>.....(Head) An. Husb.  
 H. H. Brugman<sup>1,3</sup>.....Asst. An. Husb.  
 L. M. Dorsey<sup>3</sup>.....Assoc. Dy. Husb.  
 C. G. M. Edgerly<sup>3,4</sup>.....Asst. An. Husb.  
 H. W. Hall<sup>3</sup>.....Asst. An. Husb.

#### CHEMISTRY

E. R. Tobey.....(Head) Chem.  
 Judith M. Banton<sup>2</sup>.....Asst. in Chem.  
 D. J. Dubé.....Asst. in Chem.  
 A. S. Getchell.....Asst. Chem.  
 J. S. Getchell.....Assoc. Bact.  
 C. A. Hayward.....Technician  
 M. E. Highlands.....Assoc. Food Tech.  
 J. J. Licciardello.....Asst. in Biochem.  
 E. O. Merrill.....Asst. Chem.  
 F. S. Packard.....Asst. in Chem.  
 B. E. Plummer, Jr.....Chem.  
 G. A. Waddell<sup>1</sup>.....Technician

#### ENTOMOLOGY

F. H. Lathrop.....(Head) Ent.  
 R. M. Cobb<sup>2</sup>.....Asst. in Ent.  
 C. O. Dirks<sup>3</sup>.....Assoc. Ent.  
 J. H. Hawkins.....Assoc. Ent.  
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#### FORESTRY

R. I. Ashman<sup>3</sup>.....(Head) For.  
 Gregory Baker<sup>3</sup>.....Assoc. For.  
 F. K. Beyer<sup>3</sup>.....Asst. For.

#### HOME ECONOMICS

Louise A. Stedman<sup>3</sup>.....(Head) Home Econ.  
 Mary M. Clayton.....Nutr.  
 Merna M. Monroe.....Asst. Home Econ.  
 Shirley M. Wing.....Asst. in Nutr.

#### HORTICULTURE

F. P. Eggert<sup>3</sup>.....(Head) Assoc. Hort.  
 R. M. Bailey<sup>3</sup>.....Assoc. Genet.  
 Lyle Littlefield<sup>2</sup>.....Asst. in Hort.  
 Elizabeth F. Murphy.....Asst. Biol.

#### PLANT PATHOLOGY

Donald Folsom.....(Head) Pl. Path.  
 Reiner Bonde.....Pl. Path.  
 M. T. Hilborn.....Assoc. Pl. Path.

#### POULTRY HUSBANDRY

J. R. Smyth<sup>3</sup>.....(Head) Py. Husb.  
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 C. E. Howes<sup>3</sup>.....Asst. Py. Husb.

#### FARM SUPERINTENDENTS

R. M. Cobb<sup>1</sup>.....Aroostook Farm  
 S. O. Hanson<sup>2</sup>.....Aroostook Farm  
 F. J. McDonald.....Highmoor Farm  
 I. C. Mason.....Blueberry Hill Farm

<sup>1</sup> Appointment effective after July 1, 1950.

<sup>2</sup> Resignation effective prior to June 30, 1951.

<sup>3</sup> Station work on part-time basis.

<sup>4</sup> On leave of absence during part of year.

# CONTENTS

	PAGE
FOREWORD .....	7
APPLES .....	9
Apple Fruit Fly.....	9
European Red Mite.....	9
Oyster-Shell Scale.....	10
Control of Apple Scab.....	10
Concentrated Mist Sprayer.....	10
Hardy Stocks For Apples.....	11
Apple Breeding.....	11
Storage of Apples.....	12
Fertilization of Apples.....	12
Preparation of Maine McIntosh Frozen Apple Concentrate....	13
Methods of Preparing McIntosh Apple Slices For Freezing....	13
Quality of Apples Offered For Sale in Portland, Maine.....	13
Relationship of Amount of Bruising of McIntosh to Volume of Retail Sales.....	14
Amount of Bruising During Transportation to Market in Various Types of Containers.....	15
BEANS .....	16
Weed Control in Snap Beans.....	16
Snap Bean Variety Trials.....	16
Breeding Beans Resistant to Halo Blight and Anthracnose....	16
BEEF CATTLE.....	17
Efficient Production of Beef Cattle in Maine.....	17
BLUEBERRIES .....	17
Weed Control in Low-Bush Blueberry Fields.....	19
Fertilization of Low-Bush Blueberries.....	20
Irrigation of Low-Bush Blueberries.....	20
Frost Injury to Blueberry Plants.....	21
Blueberry Fruit Fly.....	22
Blueberry Thrips.....	22
Blueberry Leaf Roller.....	22
Increasing Plant Stand in Blueberries.....	22
Pruning Experiments on the Low-Bush Blueberry.....	23
Blueberry Breeding Program.....	23
Blueberry Disease Control.....	23
Fencing to Control Deer.....	24
Blueberry Juice Products.....	25
BROCCOLI .....	25
Production of Broccoli For Freezing.....	25
Broccoli Variety Trials.....	26
CHERRIES .....	26
Experiments on Sour Cherry Culture.....	26
CORN .....	26
Control of European Corn Borer.....	26
Variety Trials of Sweet Corn For Canning.....	27
Experimental Sweet Corn Pack.....	27
Early Sweet Corn Variety Tests.....	28
Field Corn Trials.....	28



Sweet Corn Fertilization.....	28
Weed Control in Sweet Corn.....	29
Chemical Control of Nut Grass.....	29
CUCUMBERS AND MELONS.....	30
Cucumber and Melon Breeding.....	30
DAIRY .....	30
Loss of Butterfat Test in Composite Milk Samples.....	30
Factors Influencing the Fat Content of Milk.....	30
Potato Products As Feed For Dairy Cattle.....	31
Possible Mineral Imbalance in Dairy Cattle.....	31
Pedigree Studies With Dairy Cattle.....	31
Dairy Farming Cost Index.....	31
Milk Distribution Cost Changes.....	32
Relationship of Market Supply Areas and Milk Prices.....	32
Seasonal Milk Production.....	32
FORAGE CROPS.....	33
Forage Crop Nurseries.....	33
Management of Ladino Grass Pastures.....	33
Influence of Soil Fertility on Forage Production.....	33
Irrigation of Pastures.....	34
Roughage Preservation Under Maine Conditions.....	34
The Carbohydrate Composition of Some Maine Grown Roughages .....	34
FORESTRY .....	35
Increased Production of Northern White Pine.....	35
Management of Small Woodland Areas in Maine.....	36
Seasoning of Maine Woods.....	36
Suitability of Maine Woods For Posts.....	37
Natural Enemies of the Spruce Budworm.....	37
GRAIN .....	38
Small Grain Trials.....	38
HOGS .....	38
Animal Protein Factor For Swine Feeding.....	38
HOME ECONOMICS .....	39
Breakfasts of Junior High School Students.....	39
Response of Underweight, Overweight, and Normal Weight College Women to Three Kinds of Breakfasts.....	40
Nutritional Blood Tests on Adults.....	40
House Plans and Use of Rooms.....	41
Storage Space For Children's Toys.....	42
Storage in the Bathroom.....	43
IRRIGATION .....	43
Irrigation of Processing Crops.....	43
PEAS .....	44
Fertilizer Tests on Peas.....	44
Pea Trials .....	44
POTATOES .....	45
Comparison of Fungicides For Control of Early and Late Blight.....	45
Effect of Spray and Dust Treatments on Specific Gravity of Potato Tubers .....	46
Low-Gallonage, High-Concentration Sprayer.....	46
Verticillium Wilt.....	46

Control of Blackleg.....	47
Control of Spindle Tuber.....	47
Control of Latent Mosaic.....	47
Potato Red Xylem Disease.....	48
Deterioration of Potatoes in Transit.....	48
Resistance in Potatoes to Ring Rot and Late Blight.....	48
Aphid Population Trends During 1950.....	48
Weeds as Early-Summer Breeding Hosts of the Potato Aphid..	49
Relation of Aphid Abundance to Leafroll Spread and Potato Yield .....	50
Control of Aphids and Leafroll Spread.....	50
Effect of Large Applications of DDT and Toxaphene on Potato Yields and Soil Residues.....	51
Development of Leafroll Resistant Varieties.....	52
The Florida Test.....	53
Wireworm Control .....	53
Nitrogen Rate and Placement For Potatoes.....	54
Placement of Superphosphate For Potatoes.....	54
Effect of Degree of Ammoniation of Superphosphate and Liming on Use of Phosphorus.....	54
Effect of Omitting Nitrogen, Phosphorus or Potash From Fertilizer For Potatoes.....	55
Effect of Wood Sawdust as a Mulch and Incorporated in the Soil.....	56
Soil Management and Conservation Practices.....	56
Row Spacing For Potatoes.....	56
Control of Potato Tuber Size.....	56
Potato Variety Trials.....	57
Effect of Vine Killers on Potato Quality.....	57
Effect of Harvest Dates on Yield, Specific Gravity and Quality of Potatoes.....	57
Effect of Storage Conditions Upon the Value of Seed Potatoes..	58
Farm Management Adjustments and Changes in Cost of Producing Potatoes.....	58
Potato Harvester.....	59
Potato Digging Studies.....	60
Box Storage of Potatoes.....	60
Improved Equipment For Handling Potatoes in Storage.....	60
Cost of Washing and Acceptance of Washed Potatoes.....	60
Construction of Low-Cost Potato Washer.....	62
Grade Defects in Maine Potatoes.....	62
Uniformity of Size and Quality of Potatoes Shipped in Consumer Packages.....	62
Development of Shipping Containers to Reduce Bruising.....	63
Consumers' Acceptance of Green Mountain Bakers.....	63
Baking Quality of Potato Varieties.....	63
Effect of High Solids on the Economy of Processing Potato Chips and French Fries.....	63
Quality of Maine Potatoes For French Frying.....	64
Flavor Deterioration of Dehydrated Potatoes.....	64
Recovery and Feeding Value of Starch Plant Waste.....	64
Whole Cooked Dehydrated Potatoes.....	65

Open Air Freezing and Thawing of Potatoes.....	66
POULTRY .....	66
Poultry House Ventilation.....	66
High Energy-Low Fiber Rations.....	66
Potato Products as Poultry Feed.....	67
Breeding For Meat Quality in Poultry.....	68
Wholesale Egg Prices in New England.....	68
Quality of Eggs in Retail Stores.....	68
Consumer Demand and Preferences For Eggs and Poultry.....	69
Quality of Poultry Meat in Retail Stores.....	69
Costs of Producing and Marketing Broilers.....	70
RASPBERRIES .....	70
Raspberry Trials.....	70
SHEEP .....	70
Early Versus Late Lambing For Oxford Ewes.....	70
SOIL AND PLANT TESTING.....	71
Farmer Testing Service.....	71
Plant and Soil Research Analysis.....	71
Sampling Techniques For Soil Tests.....	71
STRAWBERRIES .....	71
Strawberry Breeding Trials.....	71
Vitamin C Content of Strawberries.....	72
TOMATOES .....	72
Tomato Variety Trials at Highmoor Farm.....	72
Tomato Variety Yields at Orono and Presque Isle.....	72
Vitamin C of Maine Tomatoes.....	72
Effect of Light on Tomato Vitamin C.....	73
VEGETABLE CROPS.....	73
Use of Fertilizer Phosphorus by Vegetable Crops.....	73
INSPECTION SERVICE.....	73
Testing of Dairy Glassware.....	74
Fertilizer Inspection.....	74
Fungicides and Insecticides Inspection.....	74
Commercial Agricultural Seeds Inspection.....	75
Foods Inspection.....	75
Feeding Stuffs Inspection.....	75
Gasoline and Motor Lubricants Inspection.....	76
WEATHER .....	76
PUBLICATIONS .....	77
FINANCIAL REPORT.....	80



# RESEARCH ON MAINE FARM PROBLEMS

FRED GRIFFEE, Director

G. F. Dow, Assistant Director

Research work has been conducted by the Maine Station on a total of 151 problems affecting Maine farmers and homemakers. This bulletin reports briefly on the more important facts learned from each of these projects.

A number of changes have been made during the past few years to adapt the research program to new problems and the ever changing needs of agriculture. The marketing program has been expanded to provide for more work on improved quality, consumer preferences and more efficient handling. These marketing studies include apples, dairy, potatoes, and poultry. Additional funds have been requested under the Research and Marketing Act of 1946 with the hope of starting an intensive study of blueberry marketing and processing problems.

The Department of Agricultural Engineering, which was organized in 1949-50, is developing, in cooperation with other Departments, much needed production and marketing equipment and machinery. This includes equipment for less bruising and more efficient handling of potatoes, a harrow for cutting blueberry rhizomes for increased spread of blueberry plants, and poultry house ventilation.

A more intensive forage crop program was undertaken in 1951, aided materially by a grant of funds from the Charles H. Hood Dairy Foundation. This will permit additional testing and breeding work of new varieties and strains, and a more intensive study of management factors that affect yields and winter survival.

There has been a recognized need for additional poultry research, more in line with the rapid expansion of this industry in Maine. In addition to the feeding and breeding work, a study of broiler production costs has been made, and various marketing studies are underway. A study also will be started of the duration and degree of immunity of birds to bronchitis.

The research program in Home Economics also has been expanded as a result of funds from the Research and Marketing Act of 1946. Additional work is being conducted on nutrition and on house plans and equipment for farm homes.

Research on beef cattle was started during the year with a study to determine the rate of gain as a basis for selecting more efficient breeding stock. The expanded forage crop program also will benefit both the beef and dairy industries.

Some interesting work has been conducted during the past two years using radioactive isotopes for studying the use of fertilizers by plants.

Limitations of funds and personnel do not permit conducting research on all the production and marketing problems that face Maine farmers and homemakers. During the year 1950-51, the total income of the Station was \$7127 less than in the previous year and almost \$14,000 less than two years ago, due primarily to a decrease in income from the sale of products at the experimental farms, and from slightly lower potato and blueberry tax income.

Income prospects for 1951-52 are even lower than for the current year, which poses serious problems in carrying on an effective research program in the face of recent substantial increases in costs.

A special word of appreciation and tribute is due to the members of the experiment station staff for their loyalty and devotion to their research work.

Resignations during the year included only six staff members out of a total of 67 full or part time research workers. Replacements have been made in most cases by new appointments. Dr. Roland A. Struchtemeyer replaced W. C. Libby as head of the Department of Agronomy when Professor Libby became Associate Dean of the College of Agriculture. E. S. Packard replaced Judith M. Banton in the Chemistry Department. Roger M. Cobb replaced Silas O. Hanson as Superintendent at Aroostook Farm. In the Department of Home Economics, Shirley M. Wing replaced Dorothy U. Turner; and Dr. Marion D. Sweetman will replace Dr. Louise A. Stedman who has resigned effective July 31, 1951. Other new appointments during the year included W. E. Pullen in Agricultural Economics; H. J. Murphy, L. H. Taylor, and H. W. Trask in Agronomy; R. B. Hopkins and F. W. Roth in Agricultural Engineering; H. H. Brugman in Animal Industry; and J. J. Licciardello in Chemistry. Other resignations, effective June 30, 1951, included Stanley C. Junkins in Agronomy, and Lyle Littlefield in Horticulture.

On July 1, 1951, Dr. Franklin P. Eggert, head of the Department of Horticulture, also became head of the corresponding department in the College of Agriculture, thereby coordinating both research and teaching work. This makes a total of eight departments, having a joint departmental head, comprising Agricultural Economics, Agricultural Engineering, Agronomy, Animal Industry, Forestry, Home Economics, Horticulture, and Poultry Husbandry.

Appreciation is expressed to the many farmers and homemakers who have cooperated in conducting research work on their farms to



supplement that at the regular experimental farms. The extent of such cooperation is indicated by the blueberry research program in which 42 farmers are cooperating on various blueberry research problems. The present broad research program is possible only by strong industry support evidenced by the industry taxes on potatoes, blueberries, and corn.

Recognition also is given to the special grants of funds for carrying work on specific projects, which are listed in the footnote on the last page of this report. Excellent cooperation also has been received from State and Federal Agencies including the Maine Department of Agriculture, Maine Extension Service, other Experiment Stations, and the United States Department of Agriculture.

## APPLES

**APPLE FRUIT FLY.** F. H. Lathrop, B. E. Plummer, Jr. The schedule of emergence of the flies at Highmoor Farm in 1950 was about 4 days later than normal. For the control of fruit fly in McIntosh apples 3 applications of lead arsenate (15 pounds in 60 gallons of water) in concentrated, mist spray gave a heavy deposit of arsenic, and reduced infestation of the fruit about 78 per cent, compared to apples from unsprayed, check trees.

Observations in the late summer of 1950 again emphasized the importance of flies that drift in from neglected, early apple trees, after the end of the spray season. Another possible source of future infestation of fruit flies is the quantity of small, unsalable, cull apples that were allowed to remain in some orchards, as the result of the very large crop of small apples in the season of 1950.

**EUROPEAN RED MITE.** F. H. Lathrop, M. T. Hilborn, B. E. Plummer, Jr., A. S. Getchell. During the summer of 1950, the European red mite continued to be one of the major pests of Maine apple orchards.

Research at Highmoor Farm showed conclusively that applications of sulphur dust for scab control during the summer period following apple petal fall destroyed many of the natural enemies that otherwise would help materially in keeping red mite under control. Trees that were treated with the regular post-bloom schedule of sulphur and lead arsenate were severely injured by red mites. On trees to which lead arsenate only was applied, many natural enemies were present, and the red mite population did not develop sufficiently to cause material injury.

In experimental blocks sprayed during the post-bloom period with Fungicide 341, and no sulphur, the European red mite caused no material injury. On trees in nearby blocks where sulphur was applied

through the post-bloom period it became necessary to apply special sprays for red mite control.

The injury from European red mite results from the destruction of chlorophyll in the infested leaves. The mite injury also was found to be aggravated by the presence of sulphur on the leaves, especially during periods of hot, dry weather. The loss of chlorophyll was found to reduce the size and color of the apples picked from the mite-infested trees.

**OYSTER-SHELL SCALE.** F. H. Lathrop. Applications of sulphur through the summer period also have destroyed many natural enemies of the oyster-shell scale, and have promoted increasingly severe and frequent outbreaks of the scales in Maine apple orchards.

The thorough application of dinitro spray during the dormant period reduces oyster-shell infestation, but usually does not give a satisfactory clean up of the scales. The application of lime sulphur or of oil spray during the dormant or delayed dormant periods was ineffective against oyster-shell scale.

Two carefully timed applications of DDT spray or dust put on when the young scales are hatching gave very thorough control in experimental tests. This treatment also has proved effective in commercial orchards. The time for the application of DDT for oyster-shell scale control is announced each spring.

**CONTROL OF APPLE SCAB.** M. T. Hilborn, F. H. Lathrop, E. R. Tobey, B. E. Plummer, Jr. Of the new organic fungicides, only Phygon and Fungicide 341 show sufficient promise to justify tentative recommendations. Phygon exhibits considerable "kickback" effect and in that respect approaches lime sulphur in fungicidal effect. Because of this, Phygon can be applied after an infection of scab has begun and will eradicate some of the scab spots. Fungicide 341 is strictly a protective fungicide and needs careful timing in application to be most effective.

Practically all of the new organic fungicides can safely be applied as concentrated mist spray, providing the trees are in a vigorous condition. Injury may result to trees that are weakened as by lack of fertilizer, heavy bearing, or poor site.

**CONCENTRATED MIST SPRAYER.** M. T. Hilborn. Research on the techniques of applying concentrated mist spray shows that efficient, yet low cost, equipment can be constructed. At present, the experimental sprayer is in the preliminary stage of development, but it is hoped that equipment may be constructed, as a cooperative project, which will be adapted to practical use in Maine orchards.

Two years data on scab control show that concentrated mist spray is promising as a complete spray program.

**HARDY STOCKS FOR APPLES.** M. T. Hilborn, F. P. Eggert. The hardy stock plantings at Highmoor Farm have been expanded to include two more promising stocks from Eastern Manchuria. This makes a total of 84 different hardy stocks now under observation.

A new hardy stock orchard is being planted at Highmoor Farm to study compatibility of these hardy stocks with Cortland, Red Delicious, and Golden Delicious. Experiments also will be conducted on cultural practices.

**APPLE BREEDING.** R. M. Bailey. Approximately 60 apple varieties received from other experiment stations are under observation. Of those which have fruited, only a few appear to justify further trial in Maine. Milton, Sharon, and Red Gravenstein are early varieties that appear to merit trial in a small way. Macoun, although of excellent dessert quality, is subject to storage troubles, high susceptibility to scab, alternate bearing, severe dropping, and fruit borne in clusters. Richared appears to be an improvement over standard Red Delicious at Highmoor.

A seedling orchard is under study that originally comprised approximately 1500 trees from hand-pollinated crosses. Twenty-five selections, from those that have fruited, have been propagated and placed in a second trial at Highmoor. As expected in research work of this nature,



FIGURE 1. Front and Rear View of Air Purification Unit. The trays contain activated carbon which removes ripening gasses as the air is drawn through the filter by the blower at the rear.



the majority of the trees are found to be worthless at fruiting and are removed to make room for replacements.

**STORAGE OF APPLES.** F. P. Eggert. The controlled atmosphere storage room, lined with sheet aluminum, was loaded with fruit and sealed, and daily readings on the atmosphere were taken. Carbon dioxide levels rose and it was necessary to wash the atmosphere occasionally. However, the oxygen level never dropped below 16 per cent, indicating that the room is not sufficiently gas tight. As a result the fruit kept in no better condition than fruit held under ordinary storage conditions.

Three air purification units were constructed and used in the storage rooms beginning about six weeks after the rooms were filled. There was very little influence on keeping quality but there was a noticeably better flavor of fruit kept under air purification as compared to ordinary storage conditions.

The keeping quality of fruit was compared for mulched and unmulched trees. The fruit from mulched trees held in good condition about six weeks longer than fruit from unmulched trees.

**FERTILIZATION OF APPLES.** F. P. Eggert, R. M. Bailey, M. F. Trevett. Over a ten-year period, the use of a hay or straw mulch on McIntosh apple trees at Highmoor Farm has resulted in an average annual increase in yield of 60 bushels per acre. In the 1950 growing season the increase amounted to 112 bushels per acre.

A summary of ten years results shows that the N plus mulch treatments resulted in a highly significant increase of 87 bushels per acre, or an increase of 32 per cent when compared to N alone. Mulch applied with NK or NPK also resulted in higher average yields than with NK or NPK alone. The increases involved, however, were not statistically significant.

Nitrogen alone and manure alone gave the lowest average yields. The application of NK resulted in significantly higher yields than the application of N. NPK applications resulted in higher yields than N application but the increase was not statistically significant over the period of ten years. The data indicate a response to applications of P when applied with mulch.

Fruit counts per bushel, which were taken in 1948 through 1950, showed that more apples of about the same size apparently were responsible for the higher yields of certain treatments. Fertilizer applications had no significant relationship to size of fruit.

In the Bisbee orchard there were no differences in yield due to fertilizer treatment.\* In 1950, however, there was a significantly greater

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\* Cooperative study with H. M. Leonard, Maine Extension Service.

drop on those trees which had received 2.5 pounds of epsom salts per tree annually since 1945 than on trees which had received no magnesium.

**PREPARATION OF MAINE MCINTOSH FROZEN APPLE CONCENTRATE.**  
M. E. Highlands, J. J. Licciardello, J. S. Getchell. Samples of frozen concentrated apple juice were made from McIntosh with varying degrees of maturity, from mixtures of Crab apple and McIntosh, and from McIntosh held in charcoal purified air storage. The most acceptable of the above juices were blends of one-fourth unripe and three-fourths ripe McIntosh apples.

Concentrates were made from McIntosh apple juice to which ascorbic acid was added. This resulted in a better apple flavor and one which held up better, but the color was considerably lighter than usually accepted for fresh pressed juice.

Samples made from depectinized and filtered McIntosh juice were also prepared, but these were lacking in flavor and body.

A semi plant run was made, but the equipment was not capable of maintaining vacuums high enough for satisfactory results.

**METHODS OF PREPARING MCINTOSH APPLE SLICES FOR FREEZING.**  
M. E. Highlands, J. S. Getchell. Approximately 0.05 per cent sodium bisulphite is sufficient to prevent darkening of sliced apples before and after freezing when the apples are frozen with or without sugar syrup. Ascorbic acid was also tried for preventing darkening, but this was more expensive and was not as satisfactory as sodium bisulphite.

Trials were made using calcium chloride to increase the firmness of McIntosh apples for freezing. Initial results indicate that some firming can be accomplished, but even so the frozen slices, when thawed and cooked in pies, do not hold their shape as well as some other varieties.

**QUALITY OF APPLES OFFERED FOR SALE IN PORTLAND, MAINE.\***  
C. H. Merchant, H. C. Woodward. Apples of all varieties offered for sale in 25 retail stores in Portland were carefully examined for quality at three two-week intervals during February and March, 1950. Also, prices and volume of sales of apples and competing fruits were recorded. Preliminary results of this study show:

The Apple Industry needs better grade standards for apples.  
Quality of apples varied widely and in many cases did not meet the grade claimed.

The quality of other fruits was better standardized than apples.  
A definite need exists for containers that will protect the apples from bruising and also display them to a better advantage.

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\* Cooperative study with Bur. Agr. Econ., and Prod. and Mkt. Admin., U. S. Dept. Agr.; a contribution to Northeast regional apple marketing study.

**RELATION OF AMOUNT OF BRUISING OF MCINTOSH TO VOLUME OF RETAIL SALES.** H. C. Woodward, C. H. Merchant, S. L. Painter,\* A. E. Watson.\* In the previous year, consumers showed a preference for bruise-free fruit even at some increase in price. For the 1950 crop, the volume of apples sold was recorded for a two-hour period each day from one display in each of the two stores cooperating.† The quality of the apples in each display was determined from three samples taken at the beginning, midpoint and end of the two-hour period.

The amount of bruising in the apple display increased from Monday to Thursday and then declined during Friday and Saturday. One apparent reason for these variations was fewer apple sales during the first part of the week and probably more handling of the fruit by consumers.

The amount of bruising as measured by the area of bruised fruit, increased irregularly but consistently during the five-week period of the

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\* Cooperative study with Div. of Markets, Maine Dept. Agr.; a contribution to Northeast regional apple marketing study.

† The Great Atlantic and Pacific Tea Company, and the First National Stores, Inc.

FIGURE 2. Produce Clerk Making a Retail Store Display With the Four-Pound Consumer Package. Note the master container at the right used in shipping consumer packages to the store.





study. This is difficult to explain fully and may have been due largely to the maturity of the apples over the period of study. During the latter part of the study, the apples appeared to ripen very fast when placed on display.

As the amount of bruised surface on the apples increased, the volume of retail sales declined. When the bruised surface area ranged from 20 to 39 square inches per 100 apples, retail sales averaged 12.2 pounds per hour. Sales dropped to an average of 9.0 pounds when the bruised surface area ranged from 40 to 59 square inches, and to 8.7 pounds with 60 to 79 square inches of bruised surface.

**AMOUNT OF BRUISING DURING TRANSPORTATION TO MARKET IN VARIOUS TYPES OF CONTAINERS.** H. C. Woodward, C. H. Merchant, S. L. Painter,\* A. E. Watson,\* E. P. Christopher.† During a five-week period in November and December 1950, McIntosh apples were packed at Highmoor Farm in five different types of containers and trucked to Portland warehouses and retail stores. The increase in the number of bruises one-half inch or more in diameter was least in the layer pack in wooden boxes, the Friday pack ranked second, the consumer four-pound pack was third, Keyes was fourth, and the jumble pack in wooden boxes was fifth and last. The number of bruises in the jumble pack were more than double the number found in any of the other containers.

The increase in bruising as measured by the surface area damaged was least in the four-pound consumer pack, followed by the layer pack in the wooden box. Friday pack was third, Keyes pack fourth, and again the apples in the jumble pack were bruised more than in any other container. The increase in the number of stem punctures was lowest in the Keyes and Friday packs, followed by the layer pack in the wooden box and consumer package. The jumble pack had nearly four times the amount of stem punctures as the consumer package which ranked fourth.

Two separate lots of McIntosh apples, in nine different types of containers, were transported by truck to Augusta, and by rail express from Augusta to Kingston, Rhode Island. One lot was shipped in December and the other in February. While the quantity shipped was insufficient to draw definite conclusions, the apples in the jumble pack showed the largest amount of bruising, while those in layer packs had the least amount.

The results obtained during the past season showed that the layer pack had considerable merit from the standpoint of the amount of bruising.

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\* Cooperative study with Div. of Markets, Maine Dept. Agr.; a contribution to Northeast regional apple marketing study.

† Dr. Christopher of the Rhode Island Agr. Exp. Sta. supplied information on the condition of the Maine apples shipped to Rhode Island.

ing over other types of wholesale containers, especially the jumble pack. The wooden layer pack and Keyes containers cost somewhat more than the jumble pack container. The Friday pack was the most expensive of the three layer packs. In computing costs, both material and additional labor need to be considered.

## BEANS

**WEED CONTROL IN SNAP BEANS.** M. F. Trevett, Robert Littlefield. Salts of dinitro ortho secondary butyl phenol applied approximately 48 hours before bean emergence resulted in good control of broad-leaved weeds for a period of 4 to 5 weeks. Control of annual grasses was not entirely satisfactory. The plant stand of beans was not affected by applications of 3, 6, or 9 pounds per acre.

Herbicides applied at planting did not give as good weed control as treatments applied 48 hours before emergence.

**SNAP BEAN VARIETY TRIALS.** Lyle Littlefield, E. F. Murphy. Twenty-four varieties including both named and numbered selections were tested at Highmoor for their adaptability for the home and market gardener as well as the canner. Twelve of the varieties constituted ones being tested in a cooperative trial among New England Experiment Stations and seed growers. The best yielders of 24 varieties grown at Highmoor Farm were Top Crop, Rival, and Contender, with the straightest pod going to Top Crop. Top Crop had somewhat more fiber development than many of the others and a tendency to ripen most of the pods in a short time which might be a disadvantage to home gardeners, but not to canners. Logan, Fullgreen, and Full Measure were somewhat better than many in regard to slenderness and fiber content, but were lower in yield. Of the wax varieties, there appeared to be little preference between Pencil Pod Wax, Brittle Wax, and King.

Sixteen varieties of Highmoor-grown snap beans were quick frozen and after eight months' storage were judged for flavor and texture by 15 persons. The five most palatable varieties were Tenderpod, Logan, Supergreen, Fullgreen, and Full Measure. Those of medium preference were B2008, Rival, Stringless Black Valentine, B1625, Contender, and B1515. The five least acceptable were Longreen, Emerson, Bountiful, Ranger, and Top Crop.

**BREEDING BEANS RESISTANT TO HALO BLIGHT AND ANTHRACNOSE.** R. M. Bailey, Donald Folsom, Herbert Pulsifer. Bean crosses developed for halo blight resistance of snap, shell, and dry types have been subjected each year to artificial field inoculation and infected plants have been rogued. The material exhibited a relatively high degree of resistance

last season and has become sufficiently homozygous to permit individual plant selection for desired types.

Most of the thirteen Yellow Eye type dry bean selections from controlled crosses yielded slightly less than the two strains of standard Yellow Eye in a yield trial at Monmouth. The crosses, however, were of earlier maturity which may justify further trials in northern Maine. Yields of early maturing varieties were reduced last season by a mid-summer dry period. Selections 99 B and 64 A appeared equal to the standards in productivity. Anthracnose resistance was studied in the greenhouse during the winter, and several of the selections including 99 B and 64 A exhibited a high degree of resistance compared to the standard Yellow Eye stocks.

Highmoor Yellow Eye is a selected large seeded bush strain that is now available through commercial seed outlets.

## BEEF CATTLE

**EFFICIENT PRODUCTION OF BEEF CATTLE IN MAINE.** H. H. Brugman. Three Hereford bull calves and three heifer calves, all sired by the same bull, were fed for 150 days after being weaned at seven months of age. The bull calves gained an average of 306 pounds per animal during this period as compared with 204 pounds for the heifers. The bulls consumed 792 pounds of feed per cwt. of grain; the heifers used 1002 pounds.

The gaining ability of an animal usually is related to its ability to convert feed into body weight. For the three bull calves, for example, the pounds gained per day varied between 1.84, 2.01, and 2.27. The amount of feed per 100 pounds gain for these same bulls was 849, 805, and 722 pounds respectively.

The ability to put on rapid, economical gains is readily transmitted from parent to offspring. Consequently the selective testing of breeding stock can be used to increase beef production at less cost. The Experiment Station is undertaking cooperative work with farmers in testing their beef cattle for efficiency of gain. Farmers who keep feed records and wish to have their animals weighed, should contact the Department of Animal Industry at Orono, or their county agent.

## BLUEBERRIES

A much more intensive, long time research program has been undertaken since 1945 as a result of the blueberry tax of 5½ cents per bushel. Research work is conducted on the 30 acres of land at Blueberry Hill Farm in Jonesboro. Additional research on a somewhat greater acreage is carried on with a total of 42 cooperating growers, including 20 on





FIGURE 3. Air Plane View of Blueberry Hill Farm, on Route 1 between Jonesboro and Columbia Falls.

fertilizer experiments, 6 on weed control, 10 on disease control, 3 on insect studies, 1 on irrigation, and 2 on propagation methods.

**WEED CONTROL IN LOW-BUSH BLUEBERRY FIELDS.** M. F. Trevett. Eighteen species of weeds commonly found in blueberry fields were treated with nine different chemical herbicides in 1949. Observations during 1950 confirm the previous classification of the extent to which 2,4-D will kill various weeds, which has been summarized in Station Bulletin 479, page 32. Herbicides containing 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) apparently are more effective on most woody weeds than 2,4-D alone. Contact herbicides, such as pentachlorophenol and certain aromatic oils, while giving immediate foliage kill in 1949, did not prevent resprouting in 1950. A borax compound prevented resprouting of all weeds treated. A concentration of 2000 parts per million of 2,4,5-T gave fair control of bayberry.

At the recommended rates of application used (2000 ppm), all of the herbicides injured blueberry plants; the 2,4-D esters more than the 2,4-D amines; and 2,4,5-T more than 2,4-D. Recovery of the plants from contact materials was generally better than from either 2,4-D or 2,4,5-T, but except for borax and Ammate gave poor weed control. These experiments indicate that area or blanket treatment of fields at standard rates is not safe; spot treatment of weeds only is recommended at these rates.

Treating red maple clumps for two consecutive years with Ammate (1 pound per gallon of water) resulted in 89 per cent eradication. Sprouts that did develop in 1950 were weak.

Selective control of grasses was attempted using sodium trichloroacetate. Based on 1950 observation, the maximum rate that blueberries will tolerate on newly burned land is approximately 10 pounds of the salt per acre. On first crop land, even lower rates of application destroyed fruit buds and blossoms and severely distorted the leaves. Apparently 15 to 25 pounds of the salt per acre are required for adequate suppression of grass, and upwards of 35 pounds per acre for a kill. Seventy pounds of the salt per acre prevented all growth of grass, boxberry, checkerberry, sedge, and blueberries. Weeds that survived the 70-pound rate included sheep sorrel, brake fern, dewberry, bush honeysuckle, wild strawberry, hawkweed, poplar, red maple, meadow sweet, pennyroyal, yarrow, pin cherry, willow, and sweet fern.

Because of the difficulty involved in spot treating sweet fern, blanket field applications of low concentrations of 2,4-D and 2,4,5-T were attempted. Preliminary observations indicate that 500 ppm solutions may give adequate control of sweet fern with minor injury to blueberries.

Good initial top kill of weeds was obtained with a 2,4-D-2,4,5-T mixture brushed or sprayed on the stubs or basal 3 to 4 inches of uncut bushes.

Lambkill, which is rather resistant to 2,4-D, presents a special control problem. It does not grow in clumps as do birch or alder, and compared to sweet fern it does not produce a canopy that might protect blueberry plants during spraying. However, since lambkill retains its leaves after those of blueberries have dropped, late fall treatments offer a possible method of control, and were attempted in October 1950. Models of two types of contact applicator also have been devised and will be given field trials in 1951 on weeds such as lambkill that require high concentrations of herbicides.

Another real possibility of selective control of woody weeds, without injury to blueberry plants, is the application of a herbicide either to the stubs of cut bushes or to the bottom 3 or 4 inches of standing bushes. If a nozzle with a narrow spray angle is used, it is possible to spray weeds with relative safety in thick stands of blueberries. Basal treatments applied in March and April gave a 60 to 80 per cent kill to birch, alder, poplar, maple, pin cherry, bayberry, black oak, willow, and hardhack. Tests made during the summer of 1950 indicated that the season of treatment may not be too important a factor in determining the extent of kill. All summer treatments resulted in top kill within 3 or 4 weeks following treatment. The effect of treatment on resprouting will be determined the following summer.

Preliminary data indicate that basal treatments are more expensive than foliage treatments. The cost of basal treatment, on land that contained about eight clumps of woody weeds per 100 square feet (approximately 3500 clumps per acre), was \$28.72 per acre. The estimated cost of stub treatments would be about one-third to one-half lower than for basal treatment.

**FERTILIZATION OF LOW-BUSH BLUEBERRIES.** M. F. Trevett. First crop yields from plots fertilized the burn year averaged 5.1 bushels per acre higher than unfertilized plots. Tests were continued comparing rates and kinds of fertilizers applied to fields during the first bearing year. Minor element and sawdust mulching studies were expanded. Comparisons were begun between fall applications and spring applications of fertilizer.

More details as to the results of fertilization experiments and recommended use are given in Station Mimeographed Report No. 9, "Use of Fertilizer for Maine Blueberries."

**IRRIGATION OF LOW-BUSH BLUEBERRIES.** R. A. Struchtemeyer, F. W. Peikert. Two inches of supplementary water were applied to blueberries in their first picking year. The additional water caused no increase in yield because there was an adequate supply of moisture on the unirrigated plots as shown by moisture blocks in the field.



In the fall a two-acre area was burned and a portion of this area will be irrigated for the next three years. This is an attempt to see what adequate moisture from burn to burn will produce.

**FROST INJURY TO BLUEBERRY PLANTS.** F. H. Lathrop. Widespread frost occurred on June 12 in the coastal areas in Knox, Waldo, Hancock, and Washington Counties. Although the frost did extensive damage to the blueberry crop, the frost injury was spotty. A clump of blueberry plants might be severely injured, while an adjoining group of plants showed little or no injury. Some blueberry plants were found with berries injured on part of the plant, and apparently not injured on another part of the same plant. The minimum temperature registered by the official thermometer at Blueberry Hill Farm was 35° F. Probably the minimum temperatures on much of the blueberry land dropped several degrees colder than 35°, but it seems likely that the lowest temperatures lasted only a short time, and on the whole frost was rather light. At the time of the frost the blueberry plants were well past full bloom, and most of the petals had dropped.

To learn more about the effects of frost upon blueberry plants, artificial frost was produced on very small areas by means of dry ice in a freezing cabinet placed on the blueberry land. Opened blueberry blossoms appeared to be more susceptible to frost injury than were unopened blossoms. Injury might occur to opened blossoms where there was no apparent injury to the leaves. Injury to unopened blossoms was accompanied by injury to the leaves.

Frost injury to the blossoms showed up within a few hours after the frost occurred. The first evidence of injury was a browning of the petals. Then the pistil turned brown. The ovary (developing berry) of the frosted blossom turned dark purple, a deep green, or brown, and shrivelled more or less. Severely injured blossoms and berries failed to set, and dropped from the plants.

Comparisons were made of blueberry blossoms that had been frosted, with other blossoms which had been protected from frost, but from which bees had been excluded to prevent pollination. The appearance of the frosted blossoms was very similar to the unpollinated blossoms. To tell whether failure to set fruit was due to frost or to lack of pollination, the plants should be examined soon after petal fall. If there has been much frost injury, some of the blueberry leaves probably will be injured. The leaves of some other plants on the blueberry land, especially brake fern, are even more susceptible to frost injury than are the blueberry plants. If no frost injury is evident on the leaves of the blueberry plants or brake ferns growing in the vicinity, a failure of the blueberry plants to set fruit suggests lack of pollination.

**BLUEBERRY FRUIT FLY.** F. H. Lathrop. The flies emerged in 1950 very nearly on average schedule compared with the very early emergence in 1949. In an intensive study of the injury caused by insecticides considered of value for fruit fly control, 5 different mixtures containing calcium arsenate, and 7 preparations of zinc arsenate were compared with calcium arsenate alone. None of the arsenical materials tested was found to be less injurious to the blueberry plants than the 50-10-40 (calcium arsenate-monohydrated copper sulphate-hydrated lime) dust mixture now in general use for blueberry fruit fly control in Maine.

**BLUEBERRY THRIPS.** F. H. Lathrop. Again in the spring of 1950, 5 per cent DDT dust gave promising results for thrips control. The dust was applied just as the blueberry blossom buds were separating in the clusters, shortly before the blossoms began to open. Oil (4 per cent) added to the DDT dust did not increase thrips control, and 10 per cent DDT dust did not appear markedly superior to the 5 per cent dust.

**BLUEBERRY LEAF ROLLER.** F. H. Lathrop. Small, newly hatched, leaf-roller larvae began to appear on the blueberry plants in the vicinity of Northport, Waldo County, during the third week in July. The small leaf rollers immediately began to web together the tip leaves of the infested blueberry plants. The young caterpillars fed upon the surface areas of the webbed leaves. As the caterpillars increased in size they webbed together leaves farther down the stems of the blueberry plants, and the injured areas of the leaves turned brown. By late August most of the leaves on the infested plants had been webbed together. The plants infested by leaf rollers then showed a striking resemblance to plants injured earlier in the season by the blueberry thrips.

With the approach of cold weather late in September and in October, the leaf roller caterpillars reached full growth and, leaving the clusters of rolled leaves, dropped to the ground where they entered winter quarters in the litter about the blueberry plants.

On bearing land, the 50-10-40 dust applications for fruit fly control generally gave effective control of the blueberry leaf roller. On new burn land 50-10-40 dust or 5 per cent DDT dust applied during mid-July controlled leaf roller. There was some indication that the DDT dust applied early in the season for thrips control also gave protection against leaf rollers.

**INCREASING PLANT STAND IN BLUEBERRIES.** F. P. Eggert, F. W. Peikert, Fred Roth. A light catch of blueberry plants was obtained when cuttings of underground stems or "rhizomes" were spread on the soil and disked under during the spring of the year. The extent of survival undoubtedly was reduced by very dry weather during the 1950 growing season. When planted in early September, there were no plants evident

the following spring. Uncut rhizomes seem to have produced a slightly better stand than did the six-inch cuttings. There were no differences evident where the seeding was rolled as compared to no rolling.

Additional plots were seeded in the spring of 1951 at the rate of 0, 10000, 15000, 20000, and 25000 cuttings per acre to determine the number needed to establish a good bearing field of low-bush blueberries.

An experimental disk harrow, constructed by the Agricultural Engineering Department, was used on several plots to determine the effects of cutting rhizomes in the sod on plant stand and subsequent yields.

**PRUNING EXPERIMENTS ON THE LOW-BUSH BLUEBERRY.** F. P. Eggert, F. W. Peikert, I. C. Mason. Bud counts were taken from the plots which had been pruned in the spring of 1950 by burning with a flame thrower, mowing, mowing plus a herbicidal oil, herbicidal oil alone, and mowing with a rotobeaater. A statistical analysis of these bud counts indicates that there were no differences in the number of buds per stem due to treatment. Yield records will be taken during 1951 to ascertain the effects on yield.

**BLUEBERRY BREEDING PROGRAM.** F. P. Eggert, R. M. Bailey. During the summer of 1950, ten native high-bush selections were made on the basis of berry size, color, and flavor. The selections will be moved to Blueberry Hill Farm where they can be more closely observed. Such selections will be used in an effort to find a satisfactory high-bush blueberry which will be hardy under Maine conditions.

**BLUEBERRY DISEASE CONTROL.** M. T. Hilborn. Studies during the past year indicate that twig and blossom blight, various leaf spots, and powdery mildew are the principal blueberry diseases causing serious losses to the industry. The organism causing blossom blight also causes one type of twig blight. This organism has been identified and something learned as to how and under what conditions the blueberry plant is infected. Preliminary observations indicate that Ferbam (the type name for the trademarked material known as Fermate) will aid in the control of this blight. A 10 per cent Ferbam dust, containing 7.6 per cent active ingredient, should be applied shortly before bloom, probably in the cluster bud stage when the blossom buds have separated in the cluster but the blossoms have not opened. Other fungicides are being studied to see if more effective materials can be found.

The control of various leaf spotting diseases is complicated because the causes of some of these leaf spots are not known. Leaf rust alternating from hemlock to blueberry is quite destructive to some low-bush blueberry clones. Preliminary observations indicate that a 10 per cent Ferbam dust is at least equal, and is usually superior, to 20-20-60 copper lime dust. Also the Ferbam dust is more practical to apply since an





FIGURE 4. The Blueberry Advisory Committee, Meeting in the University Greenhouse at Orono, Discusses with Dr. Hilborn the Intricate Problem of Isolating and Studying Blueberry Diseases. The blueberry tax program conducted by the Experiment Station and Extension Service is developed with the cooperation and advice of this committee. (Photo courtesy Bangor Daily News.)

application at the rate of 15 pounds per acre is comparable to an application of 20-20-60 dust at the rate of 50 pounds per acre.

There are some indications that Ferbam is also helpful in controlling other leaf spots and powdery mildew but much more needs to be done before any tentative recommendations can be made.

Laboratory studies have been made of 515 cultures obtained from diseased blueberries, of which 336 have been identified. In 263 of these samples, the organisms were not capable of causing disease in healthy blueberry plants, but were fungi such as are universally found in decaying plant tissue. Of the remaining 73 cultures, 34 are *Botryotinia* which is the organism causing blossom blight and one type of twig blight. The other 39 cultures which have been identified are being tested to see if they will reproduce disease in blueberry plants. Work is also progressing on the identification of the remaining 169 cultures.

**FENCING TO CONTROL DEER.\*** Irvin Mason. The electric fence now appears unsatisfactory for controlling deer, although when first installed in 1948, it showed considerable promise. The deer later learned

\* Cooperative project with the Maine Department of Inland Fisheries and Game.

to step over or crawl under the small single strand of electrically charged wire. When additional electrically charged strands were added, the deer learned to jump through the wires without apparent serious shock because of non contact with the ground. Due to continued deer damage with the electric fence it became necessary to protect the experiments with a seven foot woven wire fence which is being installed.

**BLUEBERRY JUICE PRODUCTS.** M. E. Highlands, J. J. Licciardello.\* Samples of blueberry juice were prepared as follows:

- (1) Plain blueberry juice, rough filtered and canned.
- (2) Plain blueberry juice depectinized, filtered and canned.
- (3) Blueberry juice depectinized, fine filtered, blended with 33 per cent McIntosh apple juice, and canned.
- (4) Blueberry juice depectinized, fine filtered, blended with 50 per cent apple juice, and canned.
- (5) Blueberry juice depectinized, fine filtered and vacuum concentrated to 40 per cent solids, and frozen.
- (6) Blueberry juice depectinized, fine filtered and made up as a syrup using cane sugar.

Samples of the above juices, except No. 5, were taste tested by the Blueberry Advisory Committee in December 1950. In general it was concluded that the blueberry apple juice combination No. 3 was most acceptable.

In addition to the above work, blueberry puree composed of screened blueberry pulp and 20 per cent sugar was prepared and frozen. This product is being tested on an experimental basis as a fruit additive and flavor for ice cream.

## BROCCOLI

**PRODUCTION OF BROCCOLI FOR FREEZING.** G. L. Terman, H. J. Murphy, C. E. Cunningham. In three tests sidedressing with 60 pounds of nitrogen from ammonium nitrate increased the yield of cut broccoli on the average by nearly 700 pounds per acre, as compared to a basic application of 1000 pounds 6-9-9 alone in row side-bands prior to setting the plants. Pinching out the center heads, as soon as they formed, reduced the yield nearly 600 pounds. Removing the center heads, however, increased the yield of side shoots, which are frequently preferred over the large center heads for freezing. Yields of plants set at Presque Isle on June 19, as compared with June 12, were lower where the center heads were removed early, but were higher where heads were left for harvest.

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\* Cooperative project with the Maine Development Commission.

**BROCCOLI VARIETY TRIALS.** Lyle Littlefield. Four varieties were observed at Highmoor Farm, but no actual yields taken due to irregular stand. Much variation in type occurred within all groups indicating a need for further breeding and selection. This variation occurred both in plant type and date of maturity. The variety, Early One, was the more uniform and appeared to be slightly better in yielding ability for the first and second cuttings.

## CHERRIES

**EXPERIMENTS ON SOUR CHERRY CULTURE.** F. P. Eggert, M. T. Hilborn, F. H. Lathrop. A total of over 300 Mahaleb seedlings have been budded with virus free Montmorency buds. Trees from this operation should be ready for orchard setting in the spring of 1952. Twelve varieties of sweet cherry have also been budded on Mazzard rootstocks to observe varietal differences for resistance to low winter temperatures.

## CORN

**CONTROL OF EUROPEAN CORN BORER.\*** J. H. Hawkins, B. E. Plummer, Jr., A. S. Getchell. Insecticides used effectively against the European corn borer during 1950 were DDT, Ryania, and Rotenone. Ryania and Rotenone were most effective when combined with so-called synergists or activators.

A single application of DDT spray resulted in control of 85 per cent of the corn borers present in 1950. The timing of this application was predicted in advance from cage records of moth emergence which indicated, within a few days, when the peak hatch would occur. More data are needed, however, as to this method of timing before recommending it as entirely reliable for one application. Best results were obtained by spraying when about 52 per cent of the borers had hatched. Enough spray should be used to secure runoff at the base of the corn plants to accomplish satisfactory control.

Publicity will be given each year so that corn growers will know when the moths emerge, when the eggs are being laid, and when the peak of hatching is likely to occur.

Either sprays or dusts are effective when their application is timed to coincide with the peak of egg hatching.

The survival of the corn borer is highest when the eggs hatch during the time when the corn tassels first appear and the pollen is shed from the tassels. The percentage survival of corn borers hatching earlier

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\* Financial assistance was given this project through the Maine Department of Agriculture from income received from the corn tax.





FIGURE 5. Either Dusting or Spraying with DDT, Ryania, or Rotenone Can be Used Effectively to Control Corn Borers. The application should be timed to the peak of hatching, which is predicted by the Experiment Station based on cage records of moth emergence.

than the midwhorl stage, and prior to tasseling, is relatively low except in rare cases of excessive infestation. Consequently it is not economical for the grower of canning corn to treat corn prior to the tassel stages. In case of early market sweet corn more protection by earlier and more frequent applications may be desired.

**VARIETY TRIALS OF SWEET CORN FOR CANNING.\*** R. M. Bailey. On the basis of yield and quality in trials at Monmouth and Fryeburg, the Maine hybrids Dirigo, Maine Tricross, Hybrid C, and Hybrid E are recommended for processing. Early maturity is in the order listed. Golden Jewel deserves trial as an early maturing hybrid for cream style pack. Seneca Chief, a very high quality, late season hybrid, matured sufficiently ahead of Golden Cross Bantam to justify further trials for whole kernel pack. Others of promise in preliminary trial were Iogold 51, Ferry-Morse Cross, and Katahdin Gold.

**EXPERIMENTAL SWEET CORN PACK.\*** M. E. Highlands, J. S. Getchell,

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\* Financial assistance was given this project by Maine Cannors Association.

J. J. Licciardello, R. M. Bailey, Buell Blair.\* Nineteen varieties of sweet corn were canned, under standard conditions, in the stages of both early and late maturity, using both the cream style and whole kernel techniques. After standing three months the various packs were cut and examined for quality by the research workers and a committee of the Maine Cannery Association. Golden Cross Bantam appeared to be the best variety. Seneca Chief, Hybrid K, No. 14048, Dirigo Line Cross, Hybrid EXM 32 and Early Golden Hybrid also showed considerable promise and were among the best samples examined.

Canning yields varied, but complete packs on late maturity cream style were not obtained due to weather conditions.

**EARLY SWEET CORN VARIETY TESTS.** E. F. Murphy, Lyle Littlefield. Of six early varieties planted at Orono on May 26, Sugar and Gold, Mason's Golden Midget, and Northland were first harvested on August 18, Dorinny and Early Golden 1.13 on August 22, Harvard Hybrid on August 25, and Golden Jewel on August 30. By August 25, Early Golden 1.13, Northland, and Sugar and Gold showed the highest yields. By September 6, Golden Jewel yielded significantly better than any of the other varieties, while Mason's Golden Midget was poorest. The latter, however, is ideal for the home gardener for freezing on the cob because of its small size and high quality. Trials at Highmoor Farm indicated that for the market gardener, the variety North Star rated high as an early large eared variety, with Golden Rule as a good midseason type. Marcross 13-6 and Early Golden 1.13 both produced well filled, attractive ears and favorable quality.

The flavor of Harvard Hybrid and Mason's Golden Midget was significantly better than that of the other four varieties grown at Orono after being frozen on the cob and stored for six months.

**FIELD CORN TRIALS.** R. M. Bailey. Yields of field corn at Highmoor Farm last season were subnormal because of a dry season and early fall frosts that occurred before full maturity of most varieties. Consequently, the experimental early maturing flint hybrids exhibited better performance than later maturing flint-dents and dents. The average of ten flint hybrids was 71.2 bushels per acre, and of six flint-dents was 65.5 bushels, including Maine B which yielded 71.7 bushels per acre. A promising three way flint-dent hybrid, F 150, has been distributed to farmers for evaluation in cooperative trials.

**SWEET CORN FERTILIZATION.** H. J. Murphy. An increase in the rates of phosphorus fertilizations from 160 to 360 pounds of  $P_2O_5$  per acre increased the yield of ears at Stillwater from 7579 to 9219 pounds

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\* Cooperative study with American Can Company.

per acre. The prices received for factory corn, however, may not warrant the higher rates of application.

An experiment in cooperation with H. C. Baxter and Bro. of the effect on yield of broadcasting part of the fertilizer was not completed due to freezing injury before the corn matured.

**WEED CONTROL IN SWEET CORN.** M. F. Trevett, R. D. Littlefield. The pre-emergence application of 2,4-D at the rate of one pound acid equivalent per acre, and salts of dinitro-o-secondary butyl phenol at the rate of three pounds of the acid per acre, gave good control of annual broad-leaved weeds for a period of five weeks. Compared to untreated plots, 2,4-D reduced the number of broad-leaved weeds 96 per cent; the dinitros reduced the number of broad-leaved weeds 95 per cent. The heights of broad-leaved weeds were reduced 58 per cent and 53 per cent, respectively.

Control of annual grasses with these herbicides was unsatisfactory, even though 2,4-D reduced the number of grass plants by 41 per cent, and the dinitros by 54 per cent.

Adequate season-long control cannot be obtained with a single pre-emergence, or post-emergence, chemical treatment. Higher rates of application, however, may prolong the effective weed-free period. An increase from three to six pounds of dinitro-o-secondary butyl phenol acid per acre, to Japanese millet seven days after sowing, had no serious effect on the height of millet. The nine pound rate reduced the height of millet one-half. The six and nine pound rates of application had no effect on corn germination, but the effect on yield is not known.

A combination of a pre-emergence treatment and a post-emergence treatment, using dinitro-o-secondary butyl phenol, when the corn was 14" tall and the grasses 5-8" tall, had no apparent effect on yield, but resulted in poor grass control. Observation indicated that grass should not be more than 1-1½" tall for successful treatment.

The application of ½ pound of 2,4-D acid per acre when the corn was 5/6" tall had no significant effect on yield.

**CHEMICAL CONTROL OF NUT GRASS.** M. F. Trevett, R. D. Littlefield. Eight pounds of 2,4-D acid per acre applied at monthly intervals from June through September suppressed top growth of nut grass, thus preventing the formation of new "nutlets."

Defoliation by a single treatment with high rates of 2,4-D in 1950 reduced subsequent sprouting up to 70 per cent.

Nutlets that were mechanically defoliated and root pruned three times during the month of June thereafter sprouted and grew normally.

## CUCUMBERS AND MELONS

**CUCUMBER AND MELON BREEDING.** Lyle Littlefield, R. M. Bailey, Donald Folsom. Work is being continued in producing scab resistant varieties of both the slicing and pickling cucumbers.

The melon breeding is an attempt to secure a variety which is early and has suitable quality for the home and market gardeners. Selections from the variety, Thousand Dollar, show early maturity but much variation occurred in quality.

## DAIRY

**LOSS OF BUTTERFAT TEST IN COMPOSITE MILK SAMPLES.** L. M. Dorsey. Studies of variation in butterfat test of composite milk samples have been continued on mixed milks of the afternoon and morning milkings of about 66 cows in the University of Maine dairy herd. The 15-day composite milk samples preserved with commercial mercuric chloride, tested 0.110 to 0.138 per cent lower than the daily fresh milk average tests. Samples preserved with either chloropicrin or acetophenone did not undergo any loss in test.

Chloropicrin ( $\text{CCl}_3\text{NO}_2$ ), also called microlysine, and commonly known as tear gas is somewhat disagreeable to use but with a little care in handling, no discomfort need be experienced. Furthermore composite samples preserved with chloropicrin process with the greatest ease. In this respect it is somewhat more satisfactory than acetophenone. Acetophenone, however, is equally effective in preventing fat test loss.

The fat loss incurred in composite samples is considered to be due to the hydrolysis of the milk fat by the enzyme lipase, producing spontaneous rancidity in the milk of individual cows. The activity releases butyric acid and glycerol which being water soluble are not extracted in the Babcock test for butterfat. The activity is prevalent when cows are on barn feed. A check of individual cows in the University herd in midwinter revealed that spontaneous rancidity occurred in 36 hours for 26 out of 66 cows, and in 60 hours for 34 of the cows.

Within 48 hours after cows are on full pasture feed, further loss of test due to hydrolysis because of lipase activity ceases. So far none of the common preserved roughages have this property of lipase enzyme inhibition, which is associated with green herbage.

**FACTORS INFLUENCING THE FAT CONTENT OF MILK.** H. C. Dickey. Cod liver oil when fed at the rate of four ounces daily per dairy cow decreases the fat test by approximately 0.5 per cent. Alpha tocopherol (Vitamin E) when fed at the rate of one ounce per head daily increases fat test approximately 0.1 per cent.



**POTATO PRODUCTS AS FEED FOR DAIRY CATTLE.** H. C. Dickey, M. E. Highlands, J. S. Getchell. Double reversal feed trials were run, using 5 pairs of Holstein cows. The potato products were fed as 20 per cent of the regular dairy ration. Dehydrated potato starch waste was very palatable for dairy cows. The results of the feeding trial show that the dehydrated potato starch waste has 92 per cent the feeding value of hominy feed or corn. The cows on the dehydrated potato starch waste produced an average of 24.6 pounds of four per cent milk as compared with 25.5 pounds for the other group of cows fed the regular ration. The cows receiving the dehydrated potato starch waste also did not maintain their body weights as well as the cows receiving the regular herd ration.

Uncooked dehydrated potatoes had a feeding value equal to that of corn or hominy feed when comprising 20 per cent of the grain mixture in two feeding trials. This product, however, was rather unpalatable when first fed.

**POSSIBLE MINERAL IMBALANCE IN DAIRY CATTLE.** H. C. Dickey. A deficiency of cobalt again was obtained in dairy heifers in the University of Maine dairy herd when a regular ration of hay and grain was fed. This deficiency was corrected, as in the previous year, by adding one teaspoon of cobalt sulfate to one ton of the grain mixture. The cobalt sulfate is first added to 20 pounds of salt and thoroughly mixed. Then the 20 pounds of salt is added to the ton of grain mixture and mixed by turning three times with a scoop shovel.

There also is some evidence that hay from highly fertilized fields may have a calcium deficiency.

**PEDIGREE STUDIES WITH DAIRY CATTLE.** H. W. Hall, H. C. Dickey. Studies with Guernsey proved sire records have shown that the production records of cow families are only slightly better measures of transmitting ability than are the dam's records alone. The average of the daughters' production of the sire, maternal grandsire, and maternal great grandsire gives the best indication of what a bull's daughters will produce.

Work also is in progress to determine the most desirable butterfat level in Holstein milk from the standpoint of efficiency of production.

**DAIRY FARMING COST INDEX.** H. B. Metzger. An index which reflects month to month changes in dairy farming costs has been constructed. This is based on changes in costs for feed, labor, machinery, farm supplies, building materials, insurance, taxes, seeds, fertilizer, dairy cows, and hay. Prices of items in the index are obtained from government publications. The base period of the index is 1935-1939. Final indexes are available by the 30th of the month for the preceding month.

In June 1950, the index was 213. The June 1951 index was 235, representing an estimated increase in cost of milk production of 10 per cent since June 1950, or 2.3 times as high as in 1935-39.

**MILK DISTRIBUTION COST CHANGES.** H. B. Metzger. Annual studies of distribution cost changes were started this year in cooperation with the Maine Milk Dealers' Association. Changes in an index of distribution costs are determined for October of each year. The index measures changes in labor, truck, container, equipment, plant supplies, building, fuel, utilities, and miscellaneous costs. Price and cost information are obtained from ten large Maine distributors, from two Boston dairy supply companies, from published wholesale commodity price indexes, and from the Maine Public Utilities Commission.

This year's study indicated that costs increased 7.9 per cent, or 0.7 of a cent per quart of retail milk, from October 1949 to October 1950. The study is published as Maine Agricultural Experiment Station Mimeographed Report No. 19.

**RELATIONSHIP OF MARKET SUPPLY AREAS AND MILK PRICES.** H. B. Metzger. Milk supply areas have been determined for Portland, Lewiston-Auburn, Waterville, Augusta, Bangor, and Boston markets. Producer price relationships among the five local markets and between local markets and Boston have been studied. Based upon historical price relationships, the normal differences between Portland and Boston (201-210 zone) Class I prices (f.o.b. plant) appear to be about 44 cents per hundredweight. About two thirds of the difference in blend price between Portland and Boston was due to Class I price differences, and about one third to differences in utilization. Prices among local markets and between local markets and Boston are closely in line when milk is in short supply. There is excessive overlapping of milk supply areas in several markets which pricing may help to correct. The volume of local milk supplies and competition for them should influence prices among markets to a greater extent.

**SEASONAL MILK PRODUCTION.** W. E. Pullen. This regional study was completed with the publication of "The Seasonal Adjustment of Milk Production in the Boston Milkshed," by M. S. Parsons, G. E. Frick, W. E. Pullen, and William Bredo. This is a mimeographed report issued by the Bureau of Agricultural Economics in cooperation with the Maine, New Hampshire and Vermont Agricultural Experiment Stations and the Boston Market Administrator, and is dated June, 1950. Opportunities of individual farmers for adjusting milk production are discussed. The influence of feeding on the pattern of production is stressed. Economies of further shifts in the present seasonal production patterns are questioned.

## FORAGE CROPS

**FORAGE CROP NURSERIES.** C. H. Moran, H. J. Murphy, L. H. Taylor. Nurseries were established at Stillwater in 1949 and at Presque Isle in 1950 for the observation of new grass and legume selections. Species under test include alfalfa, Ladino, red clover, alsike, birdsfoot trefoil, timothy, smooth brome, orchard grass, rye grass, and reed canary grass.

Many legume selections did not survive the 1949-50 winter and were replaced with other selections. One alfalfa selection from Maine seems to have promise as a winter hardy type and warrants further selection.

Orchard grass, which has been reported to lack winter hardiness, came through with 100 per cent stands. It also recovered more rapidly after cutting in June than did the other grasses.

The desired spread of maturity dates within a species, such as timothy, has not been found.

**MANAGEMENT OF LADINO GRASS PASTURES.** C. H. Moran, H. C. Dickey, H. J. Murphy. Stands of Ladino clover were reduced from 100 per cent in the fall to 25 per cent or less in the spring of 1950. The paddocks were lightly disked and reseeded to Ladino on March 19, 1951.

Greenhouse studies were made to study the effect of clipping on the organic reserves in Ladino. The storage of starch and sugars was approximately two-thirds in the stolons (stems extending along the ground), and one-third in the roots. Under greenhouse conditions a period of 9 to 12 days, following clipping at 1½ inches, was necessary before Ladino was able to synthesize more of these carbohydrates than were being used for growth. This period was somewhat shorter when Ladino was clipped at 3 inches. Total yields were as great when clipped at three inches as at one inch. Further studies of this cycle will be made under field conditions.

A summary of pasture research work was published as Bulletin 488, "Pasture Improvement," by C. H. Moran, February, 1951.

**INFLUENCE OF SOIL FERTILITY ON FORAGE PRODUCTION.** C. H. Moran, S. C. Junkins. Soil samples collected in a survey of 19 dairy farms in Penobscot County were found to be generally acid. Only one-fifth of the grassland samples had a pH above 6.0. There was a definite relationship between estimated forage productivity and soil pH. The majority of fields that were rated good were above pH 6.0 and those rated poor were below 5.5.

Levels of available phosphorus in one-half of the samples were above 5 pounds per acre, which may be adequate for forage production.

No correlation was found between estimated forage production and potassium levels in the top three inches of grassland soils. Potassium in the 3 to 6 inch soil layer was low in all tests.

**IRRIGATION OF PASTURES.** R. A. Struchtemeyer, F. W. Peikert. A pasture of average to low quality, with silt loam, was irrigated in Hampden, Maine. The forage was largely mixed grass with some Ladino clover. A total of 10 inches of supplementary water was applied to the irrigated area. The results showed an increase of 1173 pounds per acre in dry matter yield with irrigation which meant an increased income from the sale of milk of ninety dollars an acre.

**ROUGHAGE PRESERVATION UNDER MAINE CONDITIONS.** H. C. Dickey, C. H. Moran, B. E. Plummer, Jr. Chemical analyses show that grass silage is by far the most effective way of preserving the feed value of Maine grasses. There is less loss in dry matter, protein, and carotene with grass silage than with either mow-dried or sun-cured hay. The mow-dried was much superior to sun-cured hay in preserving the carotene. The carotene loss from the freshly cut grass by the time it was placed in storage was 13 per cent for the ensiled grass, 27 per cent for the mow-dried hay, and 66 per cent for the sun-cured hay. After 6 months of storage the carotene loss from the freshly cut grass amounted to 48 per cent for the silage, 86 per cent for the mow-cured hay, and 89 per cent for the sun-cured hay.

**THE CARBOHYDRATE COMPOSITION OF SOME MAINE GROWN ROUGHAGES.** B. E. Plummer, Jr., Judith M. Banton, H. C. Dickey. In the feed analysis of a group of samples, carbohydrates were determined by the old established method for crude fiber, and nitrogen-free extract. The carbohydrates were divided also by analysis into lignin, cellulose, and "other carbohydrates," which may give a better representation of the digestible carbohydrates of the feed.

The comparative analyses, by these two methods, for samples of clover, alfalfa, and grasses cut in the early stages of growth, and for samples of mixed grass and clover hay cut in mid-June are given below.

Type of sample	USUAL METHOD		NEW METHOD			Total carbohy- drates
	Crude fiber	N.F.E.	Lignin	Cellu- lose	Other car- bohydrates	
8 legumes	16.03	40.14	5.59	18.03	32.55	56.17
10 grasses	21.41	36.17	4.29	28.39	24.90	57.58
6 grass and clover	27.66	43.98	6.47	34.42	30.75	71.64

The lignin content of these immature grasses and clovers is less than that of older, more mature plants. The results of the analyses in-



dicates, however, that probably most of the indigestible lignin and some of the cellulose is reported under the old system of analysis as nitrogen-free extract (the supposedly easily digestible portion of the carbohydrates) and not as crude fiber.

The results of a digestion experiment with a Hereford steer tend to substantiate these findings. An analysis was made of a composite sample of the hay fed to the steer in each of the five feeding experiments, and of composite samples of the feces from each experiment. The results are given below.

Type of sample	USUAL METHOD		NEW METHOD			Total carbohy- drates
	Crude fiber	N.F.E.	Lignin	Cellu-lose	Other carbohy- drates	
Timothy and						
Ladino clover hay	33.44	48.13	8.97	41.95	30.65	81.57
Feces from steer	28.76	46.95	23.93	32.58	19.20	75.71

The percentage composition of crude fiber and nitrogen-free extract in the feces is very little different from that of the hay. There is a greater decrease in the percentage composition of crude fiber in the feces than that from nitrogen-free extract. This indicates a greater digestibility for crude fiber than for nitrogen-free extract.

The lignin, cellulose and "other carbohydrates" content of the hay and feces present an entirely different picture. The percentage composition of lignin in the feces has increased about 2.7 times over that in the hay while the percentage composition of cellulose has decreased about 22 per cent and "other carbohydrates" about 37 per cent. It appears that this division of the carbohydrates gives a better representation of their digestibility than when divided into crude fiber and nitrogen-free extract.

## FORESTRY

**INCREASED PRODUCTION OF NORTHERN WHITE PINE.** R. I. Ashman, F. K. Beyer, G. L. Chapman, John McGuire.\* A continuation of observational checks of young white pine in central, southern, and western Maine showed no perceptible increase in tip weevil damage. A large percentage of white pine stands seeding in during the past ten years should make straight timber.

A second year survival check was made on the white pine spacing plots established on poorly drained soils in the University Forest. Where

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\* Cooperative study with Northeastern Forest Experiment Station, Forest Service, U. S. Dept. Agr.

the sod was removed prior to planting, there has been 25 to 30 per cent additional loss from frost heaving. Where the trees were planted in the sod, there was only 2 per cent loss due to heaving this spring. Experimental mulching with slash to prevent heaving proved impracticable because of the large number of man hours required per acre.

Additional white pine plantations, 10 to 35 years of age, were measured this year, a few for the second time since 1938. The market acceptance of short logs makes the prevalence of weevil damage in some areas less important economically than it has been in the past. The general development of white pine plantations in the State shows that the species is a good one to plant.

A severe storm on November 26 caused heavy blow-down in southern and western Maine on both partially cut and uncut areas. Loss was serious in recent cuttings, but not nearly so serious where partial cuttings were made several years ago. The windfall occurring on a partial cutting plot established in Liberty in 1946 amounted to approximately 10 per cent of the residual stand. A nearby plantation thinned for pulpwood in 1946 suffered no loss.

Reconnaissance of the burned area on the Massabesic Experimental Forest\* in Alfred, as a basis for research and rehabilitation, showed that much of the land is coming back to hardwoods which will make white pine reproduction difficult, but parts of the area are seeding in to pine and others remote from a seed source can be successfully planted.

**MANAGEMENT OF SMALL WOODLAND AREAS IN MAINE.**† R. I. Ashman, G. L. Chapman, R. F. Taylor. Some progress is being made in collecting case histories of small woodland areas, including cost and income figures.

Cultural treatments applicable to small woodlands are being continued, chiefly on the University Forest. Time studies are being made on the removal of hardwood brush and weed hardwoods from young spruce stands, the thinning and pruning of young spruce and Norway pine, and girdling and poisoning of undesirable trees.

**SEASONING OF MAINE WOODS.**‡ Gregory Baker, Frank Beyer. Studies were made of the effect of time of log storage on the development of chemical brown stain of white pine under local conditions. Three groups of logs were cut in August. One group was sawed immediately after cutting, the second group was sawed after leaving in a pile in the

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\* Cooperative study with Northeastern Forest Experiment Station, Forest Service, U. S. Dept. Agr.

† Cooperative study with Maine Extension Service.

‡ Cooperative study with U. S. Forest Products Laboratory, Madison, Wisconsin.

woods for 42 days, and the third group was sawed after leaving for 93 days. Each group was placed in the kiln within a few hours after sawing. No brown stain developed in the first group, but was found at the ends of many of the boards in the second group, and showed a deeper penetration at the ends of the third group. The results are as follows:

PER CENT OF PIECES HAVING STAIN PENETRATION

Inches of stain	1st group	2nd group	3rd group
Not over 2.0	100.0	62.6	17.9
2.1 - 4.0	—	33.0	41.0
4.1 - 6.0	—	4.4	14.3
6.1 - 8.0	—	—	21.5
8.1 or more	—	—	5.3
Total	100.0	100.0	100.0

**SUITABILITY OF MAINE WOODS FOR POSTS.** Gregory Baker. An inspection of the posts set in 1946 is made annually, and the development of decay or other defects is noted. A spring balance is used to put a measured pull on each post to determine when failure occurs. In 1950, the first failures occurred with a loss of 2 posts each from the spruce, balsam fir, and beech groups. Visible evidence of decay is present in nearly all of the posts in each of the 11 species groups.

**NATURAL ENEMIES OF THE SPRUCE BUDWORM.** C. O. Dirks.\* During 1950 the spruce budworm in Maine appears to have become widely dispersed, with the result that lightly infested forest stands are now common over much of the northern part of the state. Defoliation was light practically everywhere. No serious build-up of the insect at this date seems imminent.

The budworm apparently is being kept at a low level of abundance by a number of factors. At least 10 species of native insect parasites attack the insect during its life. At each of the numerous study areas set up in northern Maine, most of these parasites have been collected. This fact indicates their wide distribution. During 1950, insect parasites were somewhat more effective than in 1949.

Insect eating birds were numerous in 1950. They appear to be im-

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\* Supervision of research upon the spruce budworm is directed by P. B. Dowden and A. T. Drooz, Div. Forest Insect Investigations, Bur. Entomology and Plant Quarantine, U. S. Dept. Agr. More information concerning this study has been published as "Natural Factors Affecting the Spruce Budworm in the Adirondacks, 1946-1948," Jour. of Economic Entomology 43:774-783. Dec. 1950. Philip B. Dowden, V. M. Carolin, and C. O. Dirks.

portant in forest stands wherever the budworm is low in numbers. The nesting season of many of the insect eating birds coincides with a period of the life cycle of the budworm in which bird depredations on the insect are highly effective.

## GRAIN

**SMALL GRAIN TRIALS.\*** S. C. Junkins. Twenty-five varieties of oats, twenty-one varieties of barley, eight varieties of winter wheat, and nine varieties of spring wheat were tested on Aroostook Farm, Presque Isle and on the Rogers Farm, Old Town. The unnamed oat selection, C. I. 4004 (Bond x Anthony), produced the highest average yield, 79.6 bushels per acre. It was followed in order by Ajax, Erban, and Abegweit. The five leading barley varieties at both locations were Vantage, Trebi, Barbless, Minn. II 41-61, and Erie. They produced an average of 53.7 bushels per acre.

The winter wheat varieties under test on Aroostook Farm did not survive the winter of 1949-50. At Old Town, Thorne and Yorkwin were the leading varieties with an average production of 52 bushels per acre. None of the spring wheat varieties tested were considered to be satisfactory for Maine conditions. Reo Negro, which was the highest producing variety in Aroostook, yielded only 23.1 bushels per acre.

The results of these tests are summarized in Mimeographed Report No. 17, "Small Grain Trials in Maine—1950."

Oat fertility trials were conducted on five farms in Aroostook County and four farms in central Maine. The fields on which the tests were located had been planted with potatoes the previous year. Three rates per acre of nitrogen fertilizer were used, namely: 15, 30, and 45 pounds. A complete fertilizer equivalent to 30 pounds of nitrogen, 60 pounds of  $P_2O_5$  and 60 pounds of potash was also included in the comparison. The results indicate that there was a slight response in central Maine to applications of phosphoric acid and potash with nitrogen but not in Aroostook County. Serious lodging was found on some of the plots receiving high applications of nitrogen.

## HOGS

**ANIMAL PROTEIN FACTOR FOR SWINE FEEDING.** H. W. Hall, H. C. Dickey. Animal proteins have long been known to contain unidentified factors necessary for growth and reproduction. This "animal protein factor," now commonly called APF, is really not a protein but rather a

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\* Cooperative study with Div. Cereal Crops and Diseases, Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.



vitamin or combination of vitamins, one of which is the new vitamin B<sub>12</sub>. At the present time several chemical firms are producing APF concentrates by fermentation processes and selling them to commercial feed outlets.

Four pigs from the same litter were divided into two lots according to sex and weaning weight. Each lot was self-fed a well balanced swine ration in the dry lot for 123 days after weaning. Lot I received a basal ration containing hominy feed, soybean oil meal, 5 per cent tankage, 5 per cent alfalfa meal, minerals and cod liver oil. Lot II received the basal ration plus one per cent APF Lederle.

Lot I made an average gain of 198 pounds per pig, consuming 430 pounds of feed per 100 pounds gain in weight. Lot II, receiving the APF factor gained 200 pounds per pig, consuming 414 pounds of feed for each 100 pounds gain in body weight. At the current price of feed, the APF was worth fifteen cents per pound.

Since the tankage in the basal ration supplied APF, both rations had some APF present. This partially explains why the APF Lederle did not produce the decidedly superior gains which other experiment stations obtained with APF fed to growing hogs.

## HOME ECONOMICS

**BREAKFASTS OF JUNIOR HIGH SCHOOL STUDENTS.\*** Mary M. Clayton. Seven-day diet records were kept by 57 junior high school students from Bucksport, Newport, and Skowhegan. The average intake of each of 11 nutrients was calculated for each meal and the contribution of the breakfasts to the day's intake of each nutrient was then studied. The results showed that in general the day's diets of the girls were apt to be especially low in calcium, iron, and vitamin C. Those of the boys tended to be deficient in calories, calcium, and vitamin C. The nutrients which were most often supplied in liberal amounts in the breakfasts of at least half of the children were those furnished by milk, eggs, cereals, enriched bread, and citrus fruits and juices. These foods supply calcium, riboflavin, thiamine, vitamin C and animal protein. For both boys and girls there seemed to be little relationship between the vitamin A and niacin in the breakfasts and in the day's meals. This was also true for calories and protein for the girls. In the case of other nutrients, when the breakfast was deficient in a particular nutrient, the whole day's food was apt to be deficient. This relationship showed up especially in regard to vitamin C.

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\* Part of the cooperative northeast regional nutrition study in which experiment stations of Maine, Massachusetts, New York, Rhode Island, New Jersey, and West Virginia are taking part.

The foods used most often for breakfast were bacon, bananas, bread (white), butter, cereal, citrus fruits and juices, cocoa, coffee, doughnuts, eggs, milk, and sugar.

**RESPONSE OF UNDERWEIGHT, OVERWEIGHT, AND NORMAL WEIGHT COLLEGE WOMEN TO THREE KINDS OF BREAKFASTS.** Shirley M. Wing, Mary M. Clayton, Rae West. College women at the University of Maine have been the subjects of tests to determine how women of different weights respond to three different kinds of breakfasts, each of which supplies 450 calories. Their response is judged from the results of blood test for sugar and chylomicrons (minute particles of fat). The breakfasts supply slightly less than one fourth of the day's food requirement for an average woman doing sedentary work. One of the breakfasts is high in starches and sugars, which are mainly supplied by bread and jam; another is high in fat, which is supplied by cream; the third is high in protein, which is chiefly supplied by skim milk and eggs. Each breakfast contains one-half cup of orange juice to supply vitamin C.

Tests on 23 normal weight or slightly overweight students show very few differences in the blood sugar tests following the three kinds of breakfasts; except that the results are usually higher at the time of the half-hour test following the breakfast which is high in sugars and starches. After this same breakfast a few subjects also show a marked drop in blood sugar at the end of the third hour. This drop in blood sugar is usually accompanied by a feeling of hunger and slight weakness. The subjects who show this drop are usually large girls who are accustomed to eating breakfasts containing more than 450 calories. The tests show that the caloric content (energy value) of the breakfast makes more difference in its satisfying qualities than the kinds of foods in the breakfast. However, the fact that starches and sugars are digested faster than proteins and fats partly explains why people are more apt to get hungry after a low calorie breakfast containing orange juice, toast, and coffee than after one containing bacon and egg.

The chylomicron and blood sugar tests show that the fat from eggs and cream appears in the blood slower than sugar, indicating the slower rate of fat digestion. The fat from eggs usually appears sooner than that from cream.

Later some definitely underweight and overweight students will be studied in order to see if they will respond to the tests differently from the normal subjects.

**NUTRITIONAL BLOOD TESTS ON ADULTS.** Mary M. Clayton, Shirley M. Wing, Rae West. Blood tests for hemoglobin, vitamin C, vitamin A, and carotene were carried out for 180 adults during Farm and Home Week. Results were similar to those secured on last year's group, with

the exceptions that more of both men and women were below normal in hemoglobin, but both men and women showed better results for carotene and the women for vitamin C. A comparison of results for 18 men and their wives showed that the women were more apt to rate low in hemoglobin and the men in vitamin C. Sex differences were slight for carotene and vitamin A.

**HOUSE PLANS AND USE OF ROOMS.** Merna M. Monroe. Three house plans were discussed with 64 mothers, who could read floor plans, to determine their preferences for seeing or talking from the kitchen to other rooms. The majority of these mothers had no desire to see or talk to company in the living room while they were working in the kitchen. Neither did most of them want the bedrooms to be within talking distance of either the kitchen or the living room, although some of the mothers mentioned the convenience of having the children's bedrooms within hearing distance from the living room or within talking distance of the kitchen when a child was sick. About half of them would like the bathroom to be within easy talking distance from the kitchen, but less than a third would like to see what is going on in the kitchen while they were busy in the bathroom.

In response to the question, "If you could have a house with one extra room besides the kitchen, living room, bathroom, and necessary bedrooms, what would that extra room be?" 30 would have a utility room and 26 would have a family activities room. The utility room would be used for laundering, and, in most instances, for ironing, sewing, and children's play. The kitchen was mentioned nearly as often as the utility room as the place for a second sitting area and for desk work. About half would have a couch in the utility room, the others would have it in the kitchen or in the living room. The majority would use the kitchen for the young child's studying and for entertaining neighbors who drop in. Older children would use their bedrooms to study and to entertain pals of the same sex.

The family activities room would be used as a second sitting room, and, in most instances, for resting, for children's play and for sewing. Some would use it for high-school children's parties. Desk work and young school children's studying were assigned here by about 15 mothers. Some of the others would do desk work in the living room to get away from the children's noise. About half of the mothers would iron here, the rest would iron in the kitchen. Neighbors who dropped in would be entertained here and in the kitchen. Older children would entertain pals of the same sex here or in their own bedrooms; the majority would study in their bedrooms.

Most of these 56 mothers would use the living room for entertaining and for quiet activities such as reading and listening to the radio.

**STORAGE SPACE FOR CHILDREN'S TOYS.\*** Merna M. Monroe. Two groups of toy-storage units, designed for use in the kitchen, were used for three to four weeks in four homes in which two children, two to eight years old, did most of their playing in the kitchen. Similarly, two sets designed for dining or living rooms were tested in four homes using the dining-living room; and two other sets were tested for use in children's bedrooms.

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\* Part of the cooperative northeast regional study on space, facility and structural requirements for farm houses in the northeastern region.

FIGURE 6. Equipment Designed for Storing Toys. The two upper pictures show the drop-leaf writing table which is attached to the bookcase shelf. The 25-inch-high end table, at the left of this bookcase, was a good "work counter" for the children to use in playing with the doll house, a garage, or similar toys. The lower left-hand picture shows a bookcase with drawers attached to one of the shelves. The lower right-hand picture shows a long writing board fastened to two bedside "commodes" where two children can work without getting in each other's way.





The 11-inch-deep bookcases were well liked, because the children could easily use them and because the cases took up the least floor space. The deep 18 to 20 inch shelves in the kitchen and in one of the dining-living room groups were not satisfactory, because the small children had to remove toys in front to get those wanted at the back, and because the mothers felt that these units took up too much floor space. Some of the mothers asked for more drawer storage, 6 or 7 inches high for doll-clothes storage and  $3\frac{1}{2}$  to 4 inches high for papers. A "writing-work" surface at the storage unit was liked because it was handy to where the children's toys and papers were stored. The mothers liked the idea of a table which could be folded up out of the way. The 22-inch-high writing surface appeared to be a convenient height for children 4 to 8 years old. The 25-inch-high end table was a somewhat better height for a "work counter" than were those 30 inches high.

**STORAGE IN THE BATHROOM.\*** Merna M. Monroe, Howard D. Bartlett. Work has begun on determining the amount of storage space needed for toilet articles, towels, and other bathroom supplies.

## IRRIGATION

**IRRIGATION OF PROCESSING CROPS.†** R. A. Struchtemeyer, F. W. Peikert. Applications of supplementary water were made on peas, wax beans, and corn on a sandy loam soil of low natural fertility, near Pittsfield.

With peas, no significant differences in the yields were noted from applications of supplementary water. This was particularly surprising since the moisture blocks used in measuring soil moisture showed considerably less available water in the non-irrigated than in the irrigated soil. Weed growth was much greater in the irrigated plots. The yields averaged about 3100 pounds per acre of shelled peas at tenderometer reading of 97.

For wax beans the non-irrigated plots yielded 8000 pounds per acre of beans while the irrigated plots yielded 7690 pounds. However, the yield of U. S. No. 1 beans was 5184 pounds per acre for the non-

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\* Part of the cooperative northeast regional study on space, facility and structural requirements for farm houses in the northeastern region.

† Cooperative study with H. C. Baxter and Bro. who planted and cared for the crops according to recommended commercial practices. Other studies on irrigation are reported under the sections for blueberries, forage crops, and potatoes.

irrigated plots and 6254 pounds for the irrigated plots, showing that a higher quality product was obtained with irrigation.

Corn showed the greatest response to the additions of water with an increase in total yield of 1600 pounds of shucked corn per acre, and an increase of 1951 pounds in marketable corn. The increase in the amount of marketable corn was due in part to the effect of irrigation on increased maturity of the corn, which was important since killing frost occurred on September 21.

## PEAS

**FERTILIZER TESTS ON PEAS.**\* H. J. Murphy, G. L. Terman, C. E. Cunningham, R. S. Leach. Experiments conducted at eleven locations in central Maine and Aroostook County showed no significant increases in yields of shelled peas for any fertilizer treatment over unfertilized plots. As in previous years, nitrogen held down the tenderometer values, but increases in yields were not measurable at tenderometer values under 105.

Preliminary investigations suggest that chemical and physical properties of the soil may explain why some farmers obtain consistently higher pea yields than others.

**PEA TRIALS.** Lyle Littlefield. Eight varieties of the dwarf and intermediate types were tested at Highmoor Farm for their adaptability to the home and market gardener. The Little Marvel variety was the earliest and among the top three in yielding ability, with Freezonian and Oneida being the better mid-season yielders. The percentage of shelled peas by weight showed no significant difference for the eight varieties tested.

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\* Tests in central Maine were in cooperation with H. C. Baxter and Bro., and in Aroostook County were in cooperation with Bird's Eye-Snyder Division, General Foods Corporation.

## POTATOES

The increased research program conducted on potatoes in recent years has been made possible by Potato Tax funds. During 1950-51, a total of \$56,976.42 was made available to the Experiment Station by the Potato Tax Committee from the one cent per barrel tax. These funds assisted in financing the following projects, which are summarized in this section.

Methods of Controlling Ring Rot.

Development of Leafroll-Resistant Varieties.

Development of Strains of Seed Potatoes That Are Free of Latent Mosaic and Certain Tuber-Borne Diseases.

Control of Aphids Through the Use of Insecticides.

Relation of Aphid Population and Leafroll Content of the Seed to the Spread of Leafroll.

Wireworm Control in Relation to Modern Production Methods.

Soil Fertility in Central Maine.

Potato Variety Trials.

Potato Top Killing and Chemical Control of Weeds in Potato Fields.

Engineering Studies of Digging, Storing, and Handling Potatoes.

Storage, Grading, and Packaging Maine Potatoes.

Potato Products, Including Recovery and Feeding Value of Starch Plant Waste.

**COMPARISON OF FUNGICIDES FOR CONTROL OF EARLY AND LATE BLIGHT.\*** Reiner Bonde, Robert Rhoads. Late blight was very prevalent in 1950, completely killing the unsprayed and the DDT control plots which became infected early in August.

In one experiment in which seven standard fungicides were compared, copper zinc chromate produced the highest yield rate of 592 bushels per acre, followed by 567 bushels for Dithane and tribasic copper sulphate, 564 bushels for copper sulphate-talc dust, 556 bushels for cuprocide-talc dust (4.1% metallic copper), and 534 bushels for Bordeaux. All of these fungicides gave complete control of late blight.

In another experiment two newly developed fungicides (Dinitro Phenol Thiocyanate and Oxygenated Dimer Hexachlorocyclopentadiene) produced significantly higher yields than the standard Bordeaux and tribasic copper sulphate spray treatments. These fungicides, however, did not give complete control of late blight when the disease was severe. Combinations of these fungicides with tribasic copper sulphate increased their fungicidal value and retained the capacity to produce high yields.

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\* Financial assistance was given this project by General Chemical Co., and Tennessee Corporation.

Varying the amount of zinc in a tribasic copper sulphate spray fungicide from 3 to 11 per cent and the copper content from 42 to 50 per cent did not affect the yield rates. A special tribasic copper sulphate containing a sticker was found to be superior to one which did not contain a sticker.

DDT and Parathion did not affect the control of late blight, when combined with Bordeaux, tribasic copper sulphate and Parzate fungicide spray mixtures. Bordeaux gave the best control of early blight followed by tribasic copper sulphate and Parzate. Parathion, either impregnated or dry mix, gave nearly perfect control of aphids with all the fungicides, but failed to control flea beetles. DDT, on the other hand, gave only fair control of aphids but good control of flea beetles.

Impregnated DDT, tribasic copper sulphate and Cuprocide dust mixtures were slightly superior to the "dry mix" dusts of the same fungicides regarding early-blight infection in 1950.

Two late applications of Bordeaux following Dithane or Parzate greatly reduced the amount of late blight infection but also reduced the yield rate by 8 to 13 barrels per acre below that of the plots treated only with Dithane or Parzate. The results for 1950 confirm those obtained in 1949.

**EFFECT OF SPRAY AND DUST TREATMENTS ON SPECIFIC GRAVITY OF POTATO TUBERS.** Reiner Bonde, Donald Merriam. The use of certain newly developed organic fungicides has produced larger yields of potatoes with low specific gravity. Applications of DDT and Parathion in combination with the different standard potato fungicides did not affect the specific gravity. Low specific gravity, however, was associated with early killing of the potato plant by the late-blight fungus.

**LOW-GALLONAGE, HIGH-CONCENTRATION SPRAYER.** Reiner Bonde, F. W. Peikert, R. B. Rhoades. The low-gallonage machine, using Dithane (D 14) at four times the usual concentration, gave complete control of late blight, being fully as effective as the conventional high pressure sprayer. Only 25 gallons of spray were applied per acre compared with 125 to 140 gallons for the conventional type sprayer. Because of lighter weight and rather simple construction, the cost of the new machine is considerably less than that of regular sprayers now being used in Maine. Due to its lighter weight, the wheel injury to the potato tops possibly may be reduced. More details concerning the results of the past year are included in Mimeographed Report No. 18, "Low-Gallonage High Concentration Sprayer for the Control of Potato Diseases and Insects."

**VERTICILLIUM WILT.** Donald Folsom, Reiner Bonde, Donald Merriam. The fungus was absent from discolored stem xylem, which resembled Verticillium-infected xylem, in maturing plants in certain Verti-



cillium-free fields. Heat treatment killed *Verticillium* in the tubers, but caused blackheart.

Sebago plants selected because of having slightly rolled apical foliage in 1949 developed *Verticillium* wilt when planted the following year. Seed stocks from hills selected as blackleg by the certification seed potato inspectors developed 20 per cent *Verticillium* wilt when planted.

Further study is needed regarding the symptoms of this disease in different varieties. Some land at Highmoor Farm has been designated for the study of soil infestation by this disease.

**CONTROL OF BLACKLEG.** Reiner Bonde. Tubers from hills that were diseased the previous year produced no disease when planted in well drained soil. In contrast potatoes planted in poorly drained soil contained about 17 per cent diseased plants. Storage temperature did not materially affect the development of blackleg. However, shifting cut seed directly from a cold bin (34-36° F.) to a warm bin resulted in seed piece decay and missing hills.

**CONTROL OF SPINDLE TUBER.** Reiner Bonde, Donald Merriam. There is evidence that the prevalence of the spindle tuber disease in Maine seed potatoes has been increasing in recent years. The disease has been found in a number of farmers' seed stocks and in seed stocks of certain newly developed varieties. The picker-type of potato planter is a source of spreading spindle tuber. Contamination of the tender sprouts of seed potatoes with the infective sap from diseased tubers was found to be an effective method of spread. The cutting knife sometimes was not an effective agent of dissemination. The Kennebec variety apparently is more susceptible to spindle tuber than is the Katahdin.

Spindle tuber is not easily eradicated merely by roguing the seed plot. Better progress has been made by selecting healthy hills or tuber units from the seed plot and then perpetuating these selections under seed plot conditions. Information on this disease has been published as Station Bulletin 487, "Potato Spindle Tuber Control," February, 1951.

Approximately 500 healthy tuber units of the different commercial varieties were selected in 1950. These were planted in 1951 and those that are healthy will be increased at the Masardis feeder farm.

**CONTROL OF LATENT MOSAIC.** Reiner Bonde, Donald Merriam. The healthy strains of seed potatoes developed at the Masardis feeder farm continued to yield significantly more than the commercial strains that were included in the test. The presence of high percentages of latent mosaic in the seed stocks caused a yield reduction of 13.7 per cent for Chippewa, 14.9 per cent for Katahdin, 16.2 per cent for Sebago, 11.2 per cent for Kennebec, 18.3 per cent for Teton, and 7.3 per cent for Mohawk.

The yield rate for the different strains of the Katahdin variety that were tested varied from 420 to 545 bushels per acre. Chippewa varied from 511 to 608 bushels. Sebago potatoes varied from 447 to 643 bushels per acre. Evidently healthy strains of seed potatoes of the same variety may differ in their yielding ability and in their plant characteristics.

**POTATO RED XYLEM DISEASE.** Donald Folsom, B. A. Friedman.\* The red xylem disease of potato tubers is caused by bacteria of at least two species or strains. While the disease has been reproduced in the laboratory, its natural development is not yet understood.

**DETERIORATION OF POTATOES IN TRANSIT.\*** Donald Folsom, H. Q. Roach.† In April, 1950, mahogany browning showed some increase in transit between Aroostook County and New York City, mostly in the form of slight symptoms in tubers that appeared healthy when shipped. In each lot of partly infected potatoes the tubers were examined in the order of decreasing size, and the disease was less common as the tubers were smaller.

**RESISTANCE IN POTATOES TO RING ROT AND LATE BLIGHT.** Reimer Bonde, R. V. Akeley,\* F. J. Stevenson,\* Donald Merriam. Progress is being made in the development of varieties of potatoes that have good marketing qualities and high resistance to late blight and ring rot. Five seedlings tested in 1950 developed neither ring rot nor late blight even after being severely inoculated under favorable conditions for these two diseases.

**APHID POPULATION TRENDS DURING 1950.** W. A. Shands,‡ G. W. Simpson. The spring migration of aphids in the vicinity of Presque Isle started earlier in 1950 than in 1949 with respect to the time when potatoes emerged from the ground. Green peach aphids, which are important carriers of the leafroll virus, were less abundant early in the summer than at the same time in 1949. Smaller numbers of spring migrants bred on wild plum in 1950 than in 1949, as shown by the records taken daily from aphid traps (Fig. 7) and from caged colonies on the primary host.

Population peaks of the aphids on untreated potatoes were reached somewhat later in 1950 than in 1949 and they were considerably higher for all species except the green peach aphid. Untreated potatoes were fed

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\* Cooperative study with Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.

† Cooperative study with Div. Markets, Maine Dept. Agr.

‡ Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

on by appreciable numbers of aphids slightly longer in 1950 than in 1949. The small numbers of green peach aphids account for the relatively small amount of leafroll spread in 1950.



FIGURE 7. Aphid Trap at Aroostook Farm for Studying the Time of Migration and the Kinds and Numbers of Aphids Entering Potato Fields.

**WEEDS AS EARLY-SUMMER BREEDING HOSTS OF THE POTATO APHID.** W. A. Shands,\* G. W. Simpson. Of three species of weeds growing in oats, lamb's-quarters proved to be the most favorable host for breeding of spring migrants of the potato aphid, followed by wild radish (kale), and wild rutabaga (mustard). The spring migrant aphids more readily deposited young aphids, and a larger percentage of them reached maturity on lamb's-quarters than on the other weeds. On these three weeds, nymphs deposited by spring migrants required an average of 12.8 days

\* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

to become wingless adults, and 14.9 days to become winged adults (summer-dispersal forms). One-half of the nymphs deposited by spring migrants on lamb's-quarters matured as winged adults, and 80 per cent of those deposited by adults of the first summer generation became winged.

These data show that potato fields may be infested early in the season by summer-dispersal forms of this aphid that develop on weeds. Infestation from the weeds can occur within two weeks after the spring migration begins. The results emphasized the need for thorough weed control early in the summer, especially in close-growing crops such as oats.

**RELATION OF APHID ABUNDANCE TO LEAFROLL SPREAD AND POTATO YIELD.** W. A. Shands,\* G. W. Simpson. Leafroll spread in Chippewa potatoes was directly related both to the size of the aphid population on the plants throughout the season and to the number of leafroll-infected plants in the plots. At high levels of aphid abundance, however, leafroll spread was related more to the percentage of infected plants, than to aphid abundance. This finding is of practical importance to seed growers, because it emphasizes the advantages of aphid control and roguing as means of maintaining good seed stocks.

Small plots of Kennebec potatoes were subjected to three seasonal levels of aphid infestation to determine the effect upon yield (Fig. 8). Maximum protection produced an increase in yield of only 17 per cent over that of unprotected plants with large aphid populations. This result is similar to that previously observed in Chippewa potatoes. Evidently both of these varieties are more tolerant of aphid feeding than is Katahdin. Aphids did not affect the total numbers of tubers set by the plants but did affect the size of the tubers.

**CONTROL OF APHIDS AND LEAFROLL SPREAD.** G. W. Simpson, W. A. Shands,\* R. M. Cobb,† P. M. Lombard.‡ Thirteen weekly applications of DDT dusts or sprays, or of a Parathion spray, increased yields of Katahdin potatoes by 71 to 125 bushels per acre over plots not treated with insecticides. Sprayed plots yielded more than dusted plots because the fungicide in sprays gave better control of late blight. DDT gave good to excellent control of buckthorn, green peach, and foxglove aphids, but unsatisfactory control of the potato aphid. Parathion gave excellent control of all four species. The dusts contained one per cent of DDT

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\* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

† Also Agent (Entomologist) Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

‡ Cooperative study with Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.





FIGURE 8. The Importance of Aphid Control is Indicated in These Pictures of Kennebec Potatoes at Aroostook Farm on Sept. 8, 1950.

The plant at the left is typical of those in plots where aphids were completely controlled; the one on the right is typical of those in plots with no control.

and four per cent of oil (impregnated), while the sprays contained 0.5 pound of DDT or 0.075 pound of Parathion per 100 gallons.

In a second experiment weekly applications of DDT increased the yield of Chippewa potatoes by 32 to 106 bushels per acre and reduced the spread of leafroll by winged aphids 67 to 94 per cent. The largest increase in yield came from weekly application throughout the season of an impregnated dust containing one per cent of DDT and four per cent of oil. There were no significant differences in yield between a DDT emulsion spray and an impregnated dust containing three per cent of DDT and four per cent of oil, irrespective of whether the weekly applications were stopped July 19, August 16, or September 13. The least effective treatments in reducing leafroll spread were those where applications were stopped in mid-July. The first application of each mixture was made on June 13, when only one-third of the potato plants were up.

In a third experiment, eight weekly applications of 1.88 pounds per acre of toxaphene from a wettable powder gave much better control of the potato aphid than similar applications of 2.5 pounds of DDT from a wettable powder, 0.63 pound of DDT from an emulsible concentrate, or of 0.25 pound of rotenone. The 1.88 pound rate of toxaphene from a wettable powder was also superior to 0.78 pound per acre of toxaphene from an emulsible concentrate.

In these experiments the weekly application rate was 35 pounds of dust or 125 gallons of spray per acre. All plots were treated weekly with yellow cuprous oxide as the fungicide.

**EFFECT OF LARGE APPLICATIONS OF DDT AND TOXAPHENE ON POTA-**

**TO YIELDS AND SOIL RESIDUES.** G. W. Simpson, W. A. Shands,\* G. L. Terman, A. S. Getchell, V. R. Boswell.† The per-acre application in the soil of 80 pounds of DDT plus 47 pounds of toxaphene, about three-fourths of both of these amounts being applied in 1948 and the rest before planting in 1950, reduced the yield of Katahdin potatoes by about ten per cent but did not significantly reduce the yield of Green Mountain potatoes. Similar rates of the two insecticides applied separately did not adversely influence yields of either variety. None of the soil treatments caused visible injury to the potato plants.

Chemical analyses of samples collected in the spring of 1949 indicated soil residues of toxaphene in plots where the amount of toxaphene applied to the soil in the spring of 1948 was at the rate of 10 or 32 pounds per acre; and of DDT in plots where 60 pounds of DDT per acre was applied to the soil in the spring of 1948, but not where the rate of application had been 15 pounds. Similar results were found in the fall of 1949 after additional amounts of the materials had been applied to the soil in the spring of 1949. The corresponding per-acre rates of application in the spring of 1949 were 6.25 or 15 pounds of toxaphene, and 5 or 20 pounds of DDT.

Eight spray applications of DDT or toxaphene to growing Green Mountain potatoes did not influence yields or injure the plants.

**DEVELOPMENT OF LEAFROLL-RESISTANT VARIETIES.** *Testing for Resistance at Highmoor Farm.* Donald Folsom. The percentage of leafroll contracted in 1949, based on observations at Highmoor Farm in 1950, was 0 per cent for seedling B24-58, 3 per cent for seedling X1276-185, 53 per cent for Katahdin, 57 per cent for Placid, 88 per cent for Chippewa, 95 per cent for Green Mountain, and 100 per cent for Kennebec. The contraction of leafroll by Chippewa, Green Mountain, and Katahdin was at about the same rate in 1949, with an unusually low aphid count, as in 1948 when aphids were abundant. The seedlings, however, contracted less leafroll in 1949, and when contracting it, generally had a greater amount of infection in the larger tubers.

Among 1531 seedlings introduced to the Highmoor Farm test in 1948, there was more leafroll resistance if both seedling parents were leafroll-resistant seedlings than if the parents included only one resistant seedling.

*Testing New Seedlings at Aroostook Farm.* G. W. Simpson, Reiner Bonde, Donald Merriam, F. E. Manzer. Seedlings introduced in previ-

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\* Cooperative study with Bur. Entomology and Plant Quarantine, U. S. Dept. Agr.

† Cooperative experiment with Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.

ous seasons but not showing current season symptoms of leafroll, following infestation with leafroll-infected green peach aphids, were replanted in 1950. In addition, 9599 new seedlings from 62 crosses and 3 selfed lines, received from Beltsville, Maryland, and some selections from Nebraska were planted in 1950. Conditions were not particularly favorable for the development of green peach aphids, and populations in August were lower than normal. At harvest 13.6 per cent of all seedlings inoculated failed to show current season symptoms of leafroll, and were saved for further testing. About 20 outstanding seedlings were saved for use as parents in the breeding program.

**Yields of Leafroll-Resistant Seedlings.** Donald Folsom, Donald Merriam. Of 38 leafroll-resistant seedlings tested at Aroostook Farm in 1950, the two with highest yields had 569 and 613 bushels an acre. No other seedling yielded more than 513 bushels an acre. In comparison, the three standard varieties, Chippewa, Katahdin, and Green Mountain yielded respectively 556, 588, and 652 bushels an acre. Yield rate was generally correlated with average tuber weight. Tuber shape was poor in the Green Mountains and in the two highest yielding seedlings.

**THE FLORIDA TEST.** G. W. Simpson, W. F. Porter,\* E. L. Newdick,\* R. M. Cobb, F. Manzer. Growers entered 878 samples in the Florida Test, representing 9215 acres of seed produced in 1950. This represents a decrease from the previous year of about 34 per cent, reflecting acreage reductions in the area.

Sixty-three per cent of the acreage qualified as foundation seed, 34 per cent as fit for table stock production, and, as in 1949, 3 per cent was judged to be unfit for further propagation.

Although the overall results showed some decrease in virus content and varietal mixture, there was a considerable increase of virus A in those varieties that can be infected with this disease, and virus X was prevalent to a serious extent in many lots of seed. Fortunately, not all lots showed infection and it should be possible to gradually eliminate badly infected stocks by replacing them with stocks tracing back to the State Seed Board Farm. Spindle tuber was again prevalent in a number of seed stocks, especially in the Kennebec variety.

Of the total acreage represented in the Florida Test, 56 per cent was of the Katahdin variety, 12 per cent was Cobbler, 11 per cent was Green Mountain, 9 per cent was Chippewa, 6 per cent was Kennebec, and the remainder included several minor varieties.

**WIREWORM CONTROL.** J. H. Hawkins, A. S. Getchell. Chlordane used at the rate of from 6 to 10 pounds per acre showed promise during 1950 of being economical and effective in controlling wireworms. Amounts

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\* Cooperative project with Div. Plant Industry, Maine Dept. Agr.

less than 6 pounds per acre were not practical in the preliminary trials. Chlordane used as a 5 per cent dust and as a 75 per cent emulsion sprayed on the surface were both effective, but the latter apparently was a little more effective than the dust. Immediate mixing of the material with the soil by the use of a disk or spring-toothed harrow appears to be essential.

Taste tests of potatoes grown in soil treated with Chlordane up to 10 pounds per acre indicated that Chlordane did not affect the quality of the potato tubers.

Ethylene dibromide was an effective soil fumigant but the cost is too high for economical use by most potato growers, and it can be used effectively only when the soil temperatures are relatively high.

Aldrin and Heptachlor also were effective but more data are needed on amounts to be applied per acre.

Wireworms persisted in plots in which witch grass (*Agropyron repens*) was allowed to grow in a potato field. Young wireworms were found during digging time in potato plots where witch grass was allowed to grow. In contrast no small wireworms were present in plots where the grass was controlled. Keeping cultivated crops free from weeds and grass remains a practical and economical method of wireworm control.

**NITROGEN RATE AND PLACEMENT FOR POTATOES.** G. L. Terman, C. E. Cunningham, Michael Goven. There was no yield advantage in 1950 from applying 60 pounds of nitrogen broadcast and 90 or 120 pounds in row side-bands for potatoes, as compared to applying all of the total of 150 or 180 pounds in row side-bands. Yields of potatoes increased up to 180 pounds of nitrogen per acre, the highest rate compared, following both millet and potatoes the previous year. As in most previous years, the increase in yield above 120 pounds of nitrogen (1500 pounds 8-12-12) was not generally profitable.

Results on "Rate, Placement and Source of Nitrogen for Potatoes in Maine" have been published in Maine Agricultural Experiment Station Bulletin 490.

**PLACEMENT OF SUPERPHOSPHATE FOR POTATOES.\*** P. N. Carpenter, G. L. Terman. Through the use of radioactive phosphorus in the fertilizer, it was found that when superphosphate was placed close to the potato seedpiece the plants obtained more of their phosphorus from the fertilizer early in the season than when the superphosphate was applied in row side-bands in the usual manner. At later stages of growth, however, more phosphorus was taken from the fertilizer applied in row side-bands.

By sampling potato plants in rows adjacent to rows fertilized with radioactive phosphorus, it was found that no cross feeding for phosphorus from one row to another had occurred.

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\* Financial assistance was given this project by Fertilizer Industry Committee on Radioactive Traver Elements.



**EFFECT OF DEGREE OF AMMONIATION OF SUPERPHOSPHATE AND LIMING ON USE OF PHOSPHORUS.\*** G. L. Terman, P. N. Carpenter, C. E. Cunningham. A part of the nitrogen in most fertilizers for potatoes and other crops is introduced into the mix through the ammoniation of superphosphate with liquid nitrogen solutions. Adding a large proportion of the nitrogen in this manner has been found to reduce the availability of the phosphorus in the fertilizer under certain conditions. Effect of degree of ammoniation on the use of phosphorus by Katahdin potatoes was studied at Aroostook Farm on unlimed and limed Caribou loam.

Through the use of radioactive or tagged phosphorus, it was found that the percentage of phosphorus in the potato plants which was taken from the fertilizer was not appreciably different for none, 3.9 or 6.7 per cent ammoniation of the superphosphate in the fertilizer. Liming also had little effect on the availability of phosphorus, as measured in this way. Degree of ammoniation and liming also had no significant effect on yield of tubers or total uptake of phosphorus by the plants. As an average of comparable treatments, potatoes absorbed 51 per cent of their phosphorus from the fertilizer at the 80 pound  $P_2O_5$  rate of application, and 58 per cent at the 160 pound  $P_2O_5$  rate. At these rates, however, less than 10 per cent of the phosphorus applied in the fertilizer was actually used by the crop.

**EFFECT OF OMITTING NITROGEN, PHOSPHORUS OR POTASH FROM FERTILIZER FOR POTATOES.** G. L. Terman. Potatoes at Aroostook Farm during 1949-50 yielded 612 bushels with 2000 pounds of 6-9-9 per acre. The soil of these plots cropped in a rotation of potatoes and green manure tested medium to high in available phosphorus and potash. Applying  $\frac{1}{4}$  the full rate of nitrogen (30 pounds) cut the yield 182 bushels, while applying  $\frac{1}{2}$  the full rate (60 pounds) cut the yield 114 bushels. Applying  $\frac{1}{3}$  the full rate of phosphorus or potash (60 pounds  $P_2O_5$  or  $K_2O$ ) cut yields only 4 and 21 bushels, respectively. Omitting the phosphorus entirely from the fertilizer for one year cut the yield 54 bushels, while omitting the potash cut the yield 77 bushels.

Omitting all potash from the fertilizer for the past four to six years has resulted in marked decreases in yield where the residual soil potash was low at the beginning of the experiment. On plots high in potash, however, nearly 600 bushels of potatoes were produced in 1950 without any potash in the fertilizer for the last four years.

These results indicate the possibility for a few years of marked reduction of the rates of phosphorus and potash applied for potatoes on soils testing high in these fertilizer elements without substantial cuts in

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\* Financial assistance was given this project by Fertilizer Industry Committee on Radioactive Tracer Elements.

potato yields. Reducing the nitrogen rate below about 90 pounds per acre, however, would result in marked reduction in yields.

**EFFECT OF WOOD SAWDUST AS A MULCH AND INCORPORATED IN THE SOIL.** P. N. Carpenter. The first year's results indicate an appreciable increase in yield with sawdust applied as a mulch, but a marked decrease in yield the first year that sawdust was incorporated in the soil.

An important effect of sawdust mulch was the marked increase in soil moisture. Sawdust as a mulch was very effective as a weed control measure.

**SOIL MANAGEMENT AND CONSERVATION PRACTICES.** R. A. Struchtemeyer, J. W. Slosser.\* The 1950-51 season was the first year of experimental operation on the Ernest Ashby farm in Caribou. The activities were confined to installing basic structures and to getting the area in shape for future rotational and runoff studies.

**ROW SPACING FOR POTATOES.** G. L. Terman, C. E. Cunningham. With a 7 inch seedpiece spacing within the row, Katahdin potatoes produced total yields of 676 bushels per acre in rows 35 inches apart, 689 bushels in 25 inch rows, and 719 bushels in 18 inch rows. With the rows and seedpieces 12 inches apart, the yield was 732 bushels. Yields of tubers below 2 $\frac{7}{8}$  inches in size were also increased by closer row spacing.

Total yields were higher for 2100 pounds of 8-12-12 fertilizer than for 1500 pounds, but yields of tubers below 2 $\frac{7}{8}$  inches decreased with the higher rate of application.

At the closer row spacings it was not possible to cultivate and ridge the rows properly, and weeds were controlled by spraying. Sunburn and field frost injured the potatoes so severely that they were not marketable. It would appear that there is little place for potato rows closer than 30 to 36 inches in Aroostook County, unless some means of preventing sunburn and field frost can be found.

**CONTROL OF POTATO TUBER SIZE.** G. L. Terman, C. E. Cunningham, S. C. Junkins, Michael Goven. Total yields of potatoes were about the same in both 1949 and 1950 at seed piece spacings of 5, 7 and 9 inches. Both closer spacing and a 2 per cent thiourea treatment of the seed increased the number of stems and the number of tubers per acre, with a decrease in the size of tubers. Decreasing the seed piece spacing from 9 to 5 inches was about 5 times as effective in increasing the number of tubers as was thiourea treatment.

When seed was spaced at 5 inches in 34-inch rows and treated with thiourea, the portion of the crop in tubers over 3 $\frac{1}{4}$  inches was only about 2 per cent for the Green Mountain and Katahdin varieties, as compared with 17 per cent for the Kennebec variety. To control over-

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\* Cooperative study with Soil Conservation Service, U. S. Dept. Agr.

size for the Kennebec and other varieties which tend to have a light set of tubers, a combination of a low rate of fertilizer, early killing, use of large seed pieces, and other cultural practices may be necessary.

**POTATO VARIETY TRIALS.** S. C. Junkins, R. V. Akeley,\* W. C. Libby, G. W. Simpson, Donald Folsom, Reiner Bonde. Nine named and six unnamed potato varieties were grown at Presque Isle, Sherman Mills, and Van Buren in Aroostook County; and at Dover-Foxcroft, Exeter, and Lee in central Maine. As an average of all locations, Essex, Ontario, Kennebec, Green Mountain, B73-10 and Pungo (B76-43) were the highest yielding varieties, in the order listed.

Mohawk, Green Mountain and B355-44 had the highest quality as shown by specific gravity. Next in order was a group of 4 varieties, Kennebec, Irish Cobbler, B61-3 and Pungo, which had the same specific gravity. Ontario and Essex, the two highest yielding varieties, were 13th and 14th of the group of 15 in specific gravity.

**EFFECT OF VINE KILLERS ON POTATO QUALITY.** C. E. Cunningham, Michael Goven. The dinitro materials, Dow General and Sinox General, were applied following the rotoblator. No appreciable amount of vascular discoloration resulted in tubers of Irish Cobbler, Katahdin, or Kennebec varieties when vines were killed by this method. Plans for 1951 include the use of certain chemicals as foliage applications to hasten maturity of tubers. This was deemed necessary since the tubers harvested in 1950 were relatively immature and skinned and bruised badly.

**EFFECT OF HARVEST DATES ON YIELD, SPECIFIC GRAVITY AND QUALITY OF POTATOES.** G. L. Terman, C. E. Cunningham, Michael Goven, Edgar Lord. Katahdin potato yields at Presque Isle from July 7 until September 12 increased at an average rate of 60 bushels per week, to give a total yield of slightly more than 600 bushels on September 12. The tubers harvested from green vines over this period increased in specific gravity from 1.038 on July 15 to 1.073 on August 24. Specific gravity did not increase appreciably after August 24, and was actually lower at the September 7 harvest, presumably because of rains preceding this date.

On other plots the vines were pulled at weekly intervals from August 22 to September 12, and the tubers left in the ground until harvested on September 19. There was little difference in specific gravity of the tubers for different dates of pulling. Skinning during harvest operations, however, was much less where the tops were pulled two weeks or more before digging.

There was no difference in French fry quality during storage of the

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\* Cooperative study with Bur. Plant Industry, Soils, and Agr. Engineering, U. S. Dept. Agr.

tubers from which the vines were removed at weekly intervals from August 22 to September 19.

**EFFECT OF STORAGE CONDITIONS UPON THE VALUE OF SEED POTATOES.** C. E. Cunningham, W. C. Libby, Michael Goven. Storage of seed potatoes at 36°, 40° and 50° F. had no significant effect on total yields. Potatoes stored at 40° and moved to 50° two weeks prior to planting emerged first, followed in order by those stored continually at 40°, 36° moved to 50°, continually at 36°, and continually at 50°. The late emergence of those stored at 50° for the entire period probably was due to sprout removal just prior to planting. In most cases, potatoes moved from 36° and 40° to 50° two weeks prior to planting produced fewer stems and tubers per hill and a lower percentage of tubers below 2 $\frac{7}{8}$  inches in diameter. Chippewa emerged first, followed by Katahdin and Kennebec.

Shrinkage losses of Chippewa, Katahdin and Kennebec potatoes during the winter of 1949-50 were greater at a storage temperature of 50° F. than at 36° and 40° F. Shrinkage of Kennebec potatoes was greater than for Katahdin and Chippewa at 36° and 40°, but was less at 50° than Katahdin and Chippewa, which produced more sprout growth at 50°.

**FARM MANAGEMENT ADJUSTMENTS AND CHANGES IN COST OF PRODUCING POTATOES.\*** W. E. Schrumpf. On 355 Aroostook County farms represented, the potato acreage decreased from 41 acres per farm in 1948 to 33 acres in 1949 and to 28 acres in 1950. Grain acreage increased from 15 acres per farm in 1948 to 22 acres in 1950. The acreages of hay, green manure crops, cropland pastured, and peas for processing also increased.

Income from potatoes made up more than 90 per cent of the average farm returns. The labor force per farm decreased only slightly and the capital investment in land, buildings and equipment remained about the same for the three years. The farmers' cost of growing and marketing potatoes, therefore, increased with each reduction in potato acreage. The approximate cost to the farmer of regular labor in growing and handling his potatoes increased from \$115 per acre of potatoes in 1948 to \$168 in 1950. The investment in potato storage houses increased from \$131 per acre to \$164 and the investment in grading and other storage-house equipment also increased. In 1948 the storage houses were filled to 95 per cent of capacity compared with 89 per cent in 1949 and 76 per cent

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\*A contribution to the Northeast regional potato marketing study. Detailed information has been published in Station Bulletin 485, "Effect of Potato Acreage Adjustments on Farm Practices in Aroostook County, Maine, 1948 and 1949," September, 1950.



in 1950. Interest on total farm capital at 5 per cent was \$44 per acre of potatoes in 1948 compared with \$67 in 1950. Preliminary figures indicate a production cost in Aroostook County in 1949 of \$428 per acre and \$2.50 per barrel. The "cash" cost was \$259 per acre and \$1.51 per barrel. On 71 farms producing potatoes in the central Maine area the average cost was very nearly the same as in Aroostook County.

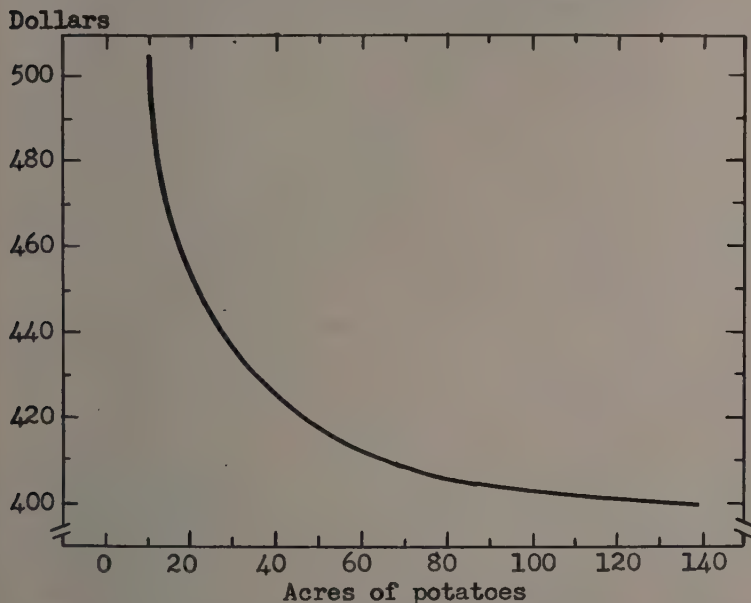


FIGURE 9. Cost per Acre of Producing Potatoes in Relation to Acres of Potatoes per Farm, on 355 Farms in Aroostook County, Maine, 1949. The per-acre cost of producing potatoes decreased as the acres of potatoes per farm increased, but at a decreasing rate. The difference in cost between 10 acres of potatoes per farm and 60 acres was about \$90 but between 60 and 140 acres only \$16 per acre.

**POTATO HARVESTER.** J. W. Slosser.\* Developments during the past season include a suitable shovel and a satisfactory top-removing device. The best shovel tested worked well under varying soil moisture conditions and was exceptionally free from clogging by stones.

A successful top-removing device utilized a series of independently mounted rubber-covered rolls to separate the tubers which clung to the vines. This device not only replaced the services of two men but also reduced by 20 per cent the amount of potatoes discarded with the tops.

\* Cooperative work with Soil Conservation Service, U. S. Dept. Agr. in studies of potato equipment for contour farming and other conservation developments.

A new type of cross elevator was constructed which reduced the amount of bruising.

Other modifications were made to increase the machine's capacity and to improve operator's working positions. Field tests indicate an increase in capacity over the previous year of two to four acres per day.

**POTATO DIGGING STUDIES.** R. B. Hopkins. In using a digger, the amount of bruising is dependent upon digger design, adjustment and use. Reducing the depth of the shovel below the top of the row from 8 to 6 inches increased the weight of bruised potatoes  $3\frac{1}{2}$  times. Changing the digger elevator from second speed with no agitation to third speed with heavy agitation increased the weight of bruised potatoes about 15 times.

In the use of potato barrels, sponge rubber, sheet rubber, a potato sack, or a creped cellulose material reduced the amount of bruising. A one-eighth inch covering of dirt on the pads reduced their effectiveness.

**BOX STORAGE OF POTATOES.** R. B. Hopkins. A comparison was made of storing potatoes in boxes and in bulk. Of the  $2\frac{1}{4}$  to  $3\frac{3}{4}$  inch diameter tubers, 11.9 per cent more were marketable from those stored in boxes than from those stored in bulk. There was no appreciable difference in shrinkage between the two storage methods.

**IMPROVED EQUIPMENT FOR HANDLING POTATOES IN STORAGE.** *Unloading in Storage House.* T. O. Brooks, F. W. Peikert. The use of a bin loader caused bruising of 2.7 per cent of the potatoes. The use of a canvas chute resulted in bruises on 3.5 per cent of the potatoes, and the conventional method of barrel dumping without any other equipment resulted in 6.5 per cent.

*Vertical Potato Elevator.* H. D. Bartlett. A vertical bucket-type elevator has been built and placed in operation. It requires little floor space, has a moderate power requirement and bruises less than 3 per cent of the tubers.

*Horizontal Potato Conveyors.* T. O. Brooks, R. B. Hopkins. A horizontal conveyor which is considerably lighter in weight and more maneuverable than those now available has been designed and constructed. A telescoping type which can be varied in length from 9 to 16 feet is being constructed. Both types will undergo tests during the next season.

**Dirt Removal.** H. D. Bartlett. The temperature in potato bins where the dirt had been removed was five degrees lower the first month of storage and three degrees lower the second month than where the dirt had not been removed. After three months there was no difference in temperature.

**COST OF WASHING AND ACCEPTANCE OF WASHED POTATOES.\*** A. L.

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\* A contribution to the Northeast regional potato marketing study.

Perry, C. H. Merchant, F. W. Peikert. Washed and unwashed potatoes packed in 10-pound "Vent Vu" bags were sold in 6 to 9 chain stores in the Boston market area for a 5-week period starting November 21, 1950. Washed potatoes were sold at a 2 cent per bag premium for two weeks, and 4 cents per bag premium for three weeks over similar quality unwashed potatoes in the same type of bags. At the 2 cent per bag premium, washed potatoes represented 59 per cent and at the 4 cent per bag premium 53 per cent of the total sales of potatoes.

Four carloads of potatoes of Amos Fletcher and Son, previously graded at Caribou, were transported to Aroostook Farm for washing. Additional amount of pickouts after washing averaged 2350 pounds per car, or 4.9 per cent of the potatoes washed. The range in the amount of culls per car was from 700 to 4000 pounds.

In washing potatoes, the dryer uses about 4 to 5 gallons of range oil an hour. It takes about 4.3 kw. of electricity per hour more to put up washed potatoes than unwashed under the same setup omitting the washing and drying operation. Water is used at the rate of about 1 to 2 gallons per minute. The additional amount of culls from washing de-

FIGURE 10. Equipment Used in Washing Potatoes at Aroostook Farm. The washing and drying equipment was loaned by the John Bean Division, Food Machinery and Chemical Corporation of Lansing, Michigan.



pend upon maturity of potatoes, the amount of external defects, most important of which are cuts and bruises, and how attractive a package a shipper wishes to pack. On potatoes washed for the Boston study, it took about 11 pounds of graded unwashed potatoes to get 10 pounds of washed potatoes. Most of this extra pound of culls can be attributed to the removal of tubers objectionable from a general appearance standpoint.

Additional costs for the investment in washing and drying equipment, water supply and sewage system, depend on a number of factors such as original cost, expected life, and amount of use.

**CONSTRUCTION OF LOW COST POTATO WASHER.** G. Fisher, F. W. Peikert. A less expensive washing unit than those presently available has been designed and constructed. Testing work is in progress to evaluate its performance.

**GRADE DEFECTS IN MAINE POTATOES.** C. H. Merchant, Jeanne Mayberry, W. E. Schrupf, Vernon Palmer,\* G. R. Warren,\* George Chick.\* A summary of seven years of Maine shipping point inspection certificates is nearly completed showing the kind and importance of various grade defects found in potatoes graded as U. S. No. 1. Cuts and bruises represent the most important defect and it is disturbing to note that this defect is increasing in relative importance in spite of a larger portion of Katahdins which do not bruise easily. One conclusion that may be made is rougher handling of less mature potatoes. The percentage of sunburn is rather closely associated with high yields of potatoes per acre.

The results of two other studies on the quality of Maine potatoes have been published as Station Bulletin 484, "Development of Defects in Potatoes Between Shipping Points in Aroostook County, Maine, and Wholesale and Retail Markets in Boston, Massachusetts," by A. L. Perry and C. H. Merchant; and Station Bulletin 486, "The Development of External Defects in Maine Potatoes at Retail Stores in Boston, Massachusetts, February and March, 1950," by R. J. A. Bouchard and A. L. Perry.

**UNIFORMITY OF SIZE AND QUALITY OF POTATOES SHIPPED IN CONSUMER PACKAGES.** C. H. Merchant, George Chick, Vernon Palmer, V. H. Nicholson.† Information is being obtained on the work sheets used in making shipping point inspections for shipments of potatoes in consumer packages. Field work began in March and will be continued to the end

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\* Cooperative study with Maine Dept. Agr. and Federal-State Inspection Service.

† Cooperative study including the Maine Agr. Exp. Sta., Maine Dept. Agr., Federal-State Inspection Service, and Prod. and Mkt. Adm., U. S. Dept. Agr.



of this shipping season. The information will help to appraise uniformity of quality of Maine potatoes shipped to market in consumer packages, and to aid in the method of sampling potatoes for inspection work.

**DEVELOPMENT OF SHIPPING CONTAINERS TO REDUCE BRUISING.** C. H. Merchant, A. L. Perry, S. L. Painter.\* Two shipments of potatoes have been made by highway express of several different types of master containers. At the time of shipment other master containers of potatoes were dropped 15 and 30 inches. Preliminary tests show that paper containers offer little protection from bruising. The use of corrugated cardboard, wooden boxes, and wooden crates as master containers for potatoes shows considerable promise for lessening the amount of bruises in handling and shipping.

**CONSUMERS' ACCEPTANCE OF GREEN MOUNTAIN BAKERS.**† C. H. Merchant. Experimental sales of a Maine Green Mountain baker were conducted in 28 retail stores in Maine for a six-week period in December and January. The potatoes were sized on Super Spud equipment to 2¾" to 3¼" and packaged in 10-pound "Vent Vu" paper bags and placed in paper master containers. The retail price was 39 cents per package of 10-pound bakers as compared with 39 cents for 15 pounds of regular U. S. No. 1 potatoes. Consumers indicated by their purchases that there was a definite market for a good baker in Maine.

Difficulty was experienced in sizing Green Mountain bakers with present equipment. Also, excessive amount of bruising occurred in many of the packages which was very objectionable from the standpoint of the consumer. Work is underway in an attempt to find ways of overcoming these difficulties.

**BAKING QUALITY OF POTATO VARIETIES.** M. E. Highlands, J. J. Licciardello, Marian D. Sweetman. Kennebec bakers were compared with Green Mountain, Katahdin, and Idaho potatoes with regard to baking quality and holding after baking. Results showed the Kennebec to be not as good as the Green Mountain and Idaho but definitely superior to Katahdin. This superiority was evident even after holding for one hour in a warming oven. Mealiness and lack of sogginess as well as taste were the bases of judging acceptability of the baked and held product.

**EFFECT OF HIGH SOLIDS ON THE ECONOMY OF PROCESSING POTATO CHIPS AND FRENCH FRIES.** M. E. Highlands, J. S. Getchell, Jack Hayes.‡

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\* Cooperative study with Div. of Markets, Maine Dept. Agr.

† Cooperative study with The Great Atlantic and Pacific Tea Company, First National Stores, Inc., Cole's Express, Bangor and Aroostook Railroad, Maine Potato Growers, Inc., and Maine Dept. Agr.

‡ Cooperative study with King Cole, Inc.

There is some evidence that high solids potatoes absorb less fat in the frying process in production of potato chips and French fried potatoes.

From an appearance standpoint chips produced under identical conditions indicate that the Kennebec is superior to Katahdin and Chippewa varieties. Samples are now under test to determine what variation in fat absorption is obtained using these three varieties. A lower fat absorption would offer an excellent sales point to buyers of Maine potatoes by potato chip manufacturers.

**QUALITY OF MAINE POTATOES FOR FRENCH FRYING.\*** G. L. Terman, C. E. Cunningham, Michael Goven. Green Mountain, Katahdin, Kennebec, Mohawk, and Teton potatoes were all unsatisfactory for French fries during the past 2 storage seasons when stored at 36° or 40° F. At these temperatures the fries were too dark in color because of their high sugar content. At 50° storage, Kennebec produced a much higher quality product, in regard to color, than did the other varieties. At 60° continuous storage, or for tubers held previously at 50° or below and then reconditioned at 60° or 70° for 20 days, all varieties produced fries of satisfactory quality, although those of the Kennebec variety were somewhat lighter in color.

Specific gravity and total solids content of the tubers increased with time in storage. Shrinkage losses increased with time in storage and with temperature of storage.

**FLAVOR DETERIORATION OF DEHYDRATED POTATOES.** M. E. Highlands, J. S. Getchell, J. J. Licciardello. The stale flavor of dehydrated Maine potatoes evidently is due to some factor in the ether soluble extract, probably natural potato fats. Work is being continued to determine the structure of the fat and it is hoped that recommendations can eventually be made which will result in the blocking of this flavor deterioration mechanism. Presumably this may be accomplished by treating the potatoes with a suitable antioxidant before drying.

**RECOVERY AND FEEDING VALUE OF STARCH PLANT WASTE.†** M. E. Highlands, J. J. Licciardello, J. S. Getchell, B. E. Plummer, Jr., J. R. Smyth, R. W. Gerry, H. Dickey. A new commercial press and mixing equipment was installed at Mapleton by the Maine Institute of Potato Starch Manufacturers, Inc. The use of this equipment was evaluated and approximately one and a half tons of dried starch plant pomace were produced for livestock feeding trials. Feeding trials, as summarized under the dairy and poultry sections, indicate that this product is not

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\* Cooperative study with Birds Eye-Snyder Div., General Foods Corp., at Caribou, Maine.

† Cooperative study with Maine Institute of Potato Starch Manufacturers, Inc.



FIGURE 11. Drier Used in Drying Starch Plant Waste for Animal Feeding Tests. A Davenport Press was best for de-watering the starch plant waste.

practical for feeding poultry but has good possibilities as a feed for dairy cows.

Drying costs probably should not exceed about \$30 per ton. This is significant since the raw materials have a zero cost.

**WHOLE COOKED DEHYDRATED POTATOES.**† M. E. Highlands, H. C. Dickey, J. R. Smyth, R. W. Gerry, C. E. Howes, J. S. Getchell. Two

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† Cooperative study with H. C. Baxter and Bro.

tons of dehydrated whole cooked diced potatoes were prepared at the Hartland plant of H. C. Baxter and Bro. Initial results from feeding trials with poultry, while incomplete, are encouraging. Feeding tests on cattle using this same material are planned for the coming summer.

**OPEN AIR FREEZING AND THAWING OF POTATOES.** M. E. Highlands, J. S. Getchell, R. H. Treadway.\* Surplus potatoes were exposed outdoors under varying conditions to natural freezing and thawing. Preliminary results indicate that this method of preparing as a dry livestock feed is of little value in Maine because of insufficient drying and other climatic conditions.

## POULTRY

**POULTRY HOUSE VENTILATION.** H. D. Bartlett, F. W. Peikert, J. R. Smyth, B. E. Plummer, Jr., F. D. Reed.† Studies were made during the summer of 1950 to compare forced ventilation with gravity ventilation under Maine broiler housing practices. The results of the first season do not indicate any significant temperature difference between pens with adequate gravity ventilation and pens equipped with supplementary mechanical ventilation.

Studies also were conducted during the winter to determine the required amount of air change, and the effect of air distribution within the pen, to the maintenance of favorable litter conditions. This problem will require more intensive study.

From observations made to date it appears necessary to provide insulation on all exposed surfaces of broiler houses in order to reduce objectionable condensation. Supplemental heat also appears necessary in most houses throughout the growing period during local winter weather.

**HIGH ENERGY-LOW FIBER RATIONS.** R. W. Gerry, J. R. Smyth, C. E. Howes. Egg production for 11 months by sex-linked (Red-Rock) hens, when fed a low fiber ration, was similar to that with a high fiber ration. The rate of feed consumption, however, was only 24.5 pounds daily per 100 hens fed the low fiber ration as compared with 29.5 pounds for high fiber ration. Thus the low fiber ration made a saving of 17 per cent, or 5 pounds of grain daily per 100 hens.

Excellent growth, feed efficiency, egg production and egg size also were obtained from rearing 41 pullets for 36 weeks on NECC High Energy Starter and Broiler ration.

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\* Cooperative study with Eastern Regional Research Laboratory, U. S. Dept. Agr.

† Cooperative study with Maine Extension Service.



Since the rations fed to date were high protein starting rations, a trial was conducted using lower protein laying rations. The percentage egg production of one lot fed a conventional type medium fiber ration and two lots fed high energy-low fiber rations was similar for 10 months. The feed required per dozen eggs was 5.41 pounds on the medium fiber and 4.60 and 4.86 pounds on the low fiber rations. Birds fed the low fiber ration weighed an average of 0.4 pound more than those fed the medium fiber ration, and ate at a rate of 2.0 to 2.6 pounds less feed per 100 birds per day.

A trial with two lots, each consisting of 56 R.I. Red pullets selected and paired on the basis of previous egg production, were fed conventional and high energy laying rations. The results were similar to those obtained in previous trials.

Four lots of male and female chicks were reared to 14 weeks of age. One lot was fed the NECC conventional type starter with a medium fiber ration, two other lots were fed high energy rations containing commercial vitamin bases, and a fourth lot was fed the NECC High Energy Starter and Broiler ration. Average gains of all lots fed the high energy rations were significantly greater than those of the birds fed the conventional ration. The ration fed in the Maine Broiler Test during 1949 gave superior growth and feed efficiency as did the other high energy ration containing a commercial base. Return over feed cost for the combined males and females ranged from 4.5 to 5.5 cents per bird more when the high energy rations were fed even though the high energy rations cost from 20 to 30 cents per 100 pounds more than the conventional ration.

**POTATO PRODUCTS AS POULTRY FEED.** R. W. Gerry, J. R. Smyth, C. E. Howes, M. E. Highlands, J. J. Licciardello, J. S. Getchell, B. E. Plummer, Jr. Potato starch pomace was used to replace corn to the extent of 5.0 and 7.5 per cent in a New England College Conference starting ration. The pomace used gave even poorer feed efficiency than the sample used in previous trials. Furthermore, with the new sample there was a decrease in the growth rate of the males which approached significance, although that of the females was not affected by the levels fed. The high level of calcium in starch pomace (4 per cent) may be partially responsible for the poor results obtained. A mixture of vitamins added to the ration containing 7.5 per cent pomace improved feed efficiency somewhat, but growth rates were not affected significantly.

In another experiment with older chickens, adjustments were made to the NECC growing ration to maintain similar levels of protein minerals and vitamins with starch pomace replacing 10, 15 and 20 per cent of the corn as well as one-eighth and one-fourth of the grain mixture of corn,

oats and middlings. A higher cost of feed per pound of gain resulted in all but one case when pomace was used. The decrease in feed efficiency was nearly proportional to the amount of pomace used. This was due to slower growth, poorer feed efficiency, or both. When more than 10 per cent of pomace was used, the growth rate was decreased significantly.

Dehydrated, *cooked* whole potatoes were fed to eight lots of sex-linked (Red-Rock) chicks up to 8 weeks of age. The potato product replaced in the NECC starting ration 0, 5, 10, 15, 20 and 25 per cent of corn, 10 per cent of barley and 10 per cent middlings respectively. Feed efficiency was not appreciably affected by any of the levels fed up to 20 per cent. A significant decrease in growth occurred at the 25 per cent level, and a nearly significant decrease occurred for males at the 20 per cent level.

**BREEDING FOR MEAT QUALITY IN POULTRY.** C. E. Howes, J. R. Smyth, R. W. Gerry. Barred Plymouth Rock and Rhode Island Red chicks from the station flock which were selected for growth were heavier at both eight and twelve weeks of age than were unselected chicks from the college flock. Feed efficiency was also better with the station birds. The work indicates that the faster the growth, the less feed is required to produce a pound of meat.

A recent disease problem with the Rocks has resulted in a severe setback with the breeding work for that breed. However, the egg production and hatchability on the Reds is very satisfactory and continues to be as good as the original stock.

**WHOLESALE EGG PRICES IN NEW ENGLAND.** A. A. Brown,\* W. E. Savage, C. H. Merchant. A preliminary report, published by Massachusetts, includes price data for 115 poultrymen in Maine. The present price-making system is inadequate and does not always present true market conditions. More statistics on receipts, stocks and movement of eggs are required to develop a market-pricing system. Sources of information should be broadened to include operations of principal receivers at various points in New England. Information should be obtained daily on receipts of comparative egg types at New York City. The information obtained should be analyzed either by the USDA Market News Service or by a public or private agency which would publish a guide price once or twice weekly.

**QUALITY OF EGGS IN RETAIL STORES.** W. E. Savage, C. H. Merchant, S. L. Painter,† N. Nybrotten.‡ Information was obtained on the quality

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\* Cooperative northeast regional poultry marketing study, with A. A. Brown of Massachusetts Agr. Exp. Sta. as project leader.

† Cooperative study with Maine Dept. Agr.

‡ A contribution to the Northeast regional poultry marketing study of which Dr. Nybrotten, West Virginia Agr. Exp. Sta., is leader.

of eggs offered for sale in 594 retail stores in Maine during the summer of 1949. Of the stores visited, 80 per cent were independent, 14 per cent were associated with wholesale units, and 6 per cent were national chain outlets. Nearly 55 per cent of the stores were buying eggs direct from farmers and 45 per cent were buying from wholesale receivers.

Sixty five per cent of the stores offered consumers only one size of eggs, 25 per cent offered two sizes, and 10 per cent offered three or more sizes. The most common size of eggs offered was large eggs. In the total of over 21,000 eggs examined, 87 per cent were grade A, 12 per cent were grade B, and one per cent grade C.

**CONSUMER DEMAND AND PREFERENCES FOR EGGS AND POULTRY MEAT.** W. E. Savage, C. H. Merchant. Six hundred families in Portland and South Portland were interviewed during the summer of 1950 to obtain information on their demand and preferences for eggs and poultry meat. Most families buy eggs once each week. Consumers are very price and color conscious as far as eggs are concerned. Most of those interviewed preferred brown eggs. Most housewives do not purchase any particular brand of eggs. Specific grades do not influence purchases of eggs as many consumers indicated that they wanted good quality and purchased eggs from the same source as long as they felt they were getting the quality they desired. The type of carton in which eggs are available at their regular source of supply is usually the type for which a preference has been expressed. More eggs are consumed during the winter months when housewives tend to cook more eggs and serve "heavier" breakfasts.

In buying poultry meat, about one third of the families purchased poultry during the seven days previous to the date of interview. Most of the purchases were made on Friday and Saturday and were served at the noon meal on Sunday. The independent retail store was the most common source of supply. Weight was the primary factor in the selection of poultry. Fowl and fryers were the predominate types of poultry purchased. Many housewives, unfamiliar with grades and the characteristics of quality, asked their storekeeper or butcher to select their bird for them.

**QUALITY OF POULTRY MEAT IN RETAIL STORES.** W. E. Savage, C. H. Merchant, S. L. Painter.\* This study involved interviews with over 100 retailers in the Portland market to determine the quality and types of poultry meat offered for sale during the summer of 1950. An inspector of the State Department of Agriculture graded two birds from each type of poultry in the store. Information also was obtained on the weekly sales of poultry meats, daily distribution of sales for selected

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\* Cooperative study with Maine Dept. Agr.

weeks by kind of poultry, and the methods used to display poultry to the consumer.

The study indicated that the poultry industry needs new grading standards for dressed and processed poultry meat. Retailers are not well satisfied with the quality and size of the birds they are able to purchase. Most independent retailers handle poultry only at the last of the week. There is a definite need for a promotional campaign to induce retailers to handle poultry throughout the week. Storekeepers tend to dislike the New York dressed form which requires the stores to use valuable time in drawing the birds for the customer. Most customers are unwilling to draw such birds themselves.

**COSTS OF PRODUCING AND MARKETING BROILERS.** W. E. Savage, C. H. Merchant. During the past summer, 96 broiler farms and 9 major dressing plants in Maine were surveyed to determine costs, returns, and management practices of growers and dressing plants in producing 214 lots of broilers on a contract basis. The survey also included information on present types of farm enterprises being carried on in conjunction with broiler production, and the history of previous farming operations.

Results show that the cost to the dressing plants was 29 cents to produce one pound of meat. Feed accounted for 68 per cent of the total cost, baby chicks 13 per cent, the amount paid the grower for his labor and use of buildings and equipment was 13 per cent, and miscellaneous costs were 6 per cent. Gross receipts to farmers per bird was 13 cents, of which 5.5 cents was used by him in paying expenses other than labor, providing him a labor return of 7.4 cents per bird.

## RASPBERRIES

**RASPBERRY TRIALS.** R. M. Bailey, Lyle Littlefield. Four raspberry varieties tested at Highmoor Farm yielded in the descending order of Taylor, Latham, Sunrise, and Milton. Taylor produced larger and better quality berries than Latham but has exhibited greater susceptibility to mosaic. Satisfactory winter survival was evident this spring for all but Milton. Plots mulched with shavings or hay yielded significantly more than those in clean culture.

## SHEEP

**EARLY VERSUS LATE LAMBING FOR OXFORD EWES.** H. C. Dickey, H. H. Brugman. The ewes which were bred in September on pasture had an average of 1.7 live lambs each. Forty per cent of the ewes had single lambs and sixty per cent had twin lambs. All single lambs were born alive and survived. One-third of the twin lambs were either born



dead or died within a few days after birth, and one-third of the live lambs died within eleven weeks after birth. Cobalt was added to the ration between the 11th and 12th weeks. No more deaths occurred after that date, and the lambs appeared to be more thrifty and to make better gains.

Sheep should have free access at all times to a mineral mixture consisting of:

- 100 lbs. salt to which has been added one ounce of cobalt sulfate or cobalt carbonate
- 100 lbs. ground limestone
- 100 lbs. steamed bone meal or dicalcium phosphate.

## SOIL AND PLANT TESTING

**FARMER TESTING SERVICE.** P. N. Carpenter, Harry Trask, Marion Harvey. A total of 18,148 soil samples were analyzed as a farmer service during the calendar year of 1950. These samples were analyzed for acidity (pH), readily soluble phosphorus, potassium, calcium, and magnesium. In addition, nitrate nitrogen and soluble salts were determined on greenhouse samples. A charge of 50 cents was made for each sample tested.

**PLANT AND SOIL RESEARCH ANALYSIS.** P. N. Carpenter, Marion Harvey. Soil samples analyzed in connection with research projects totaled 440 analyses for total nitrogen, exchangeable calcium and potassium, soluble phosphorus, and pH.

A total of 2192 plant tissue samples from potato top tubers, pea silage, beans, corn, tomatoes, and clover were analyzed for total nitrogen, phosphorus, potassium, and calcium.

Analyses for radioactive counts were made on 370 samples of potatoes, corn, beans, tomatoes, and blueberries. Radioautographs were made of each of the species of plants sampled.

**SAMPLING TECHNIQUES FOR SOIL TESTS.** P. N. Carpenter. Preliminary work on soil sampling techniques was initiated in July 1950. Results to date indicate that sampling methods in use are adequate under usual conditions.

## STRAWBERRIES

**STRAWBERRY BREEDING TRIALS.** R. M. Bailey, E. F. Murphy, Lyle Littlefield. Three new strawberry varieties produced by the Maine Station are Orland (No. 127), Monmouth (No. 81), and Maine 55. The results of trials at Highmoor Farm and by a few cooperating growers suggest that these varieties have sufficient merit to justify release to the public for trial under Maine conditions. Foundation stock has been

distributed to several plant growers and a general supply of plants should be available next spring. These new varieties have been outstanding in productivity, winter survival, and plant making ability. The berries are of good size, attractive, and similar to Howard 17 in quality and firmness.

The flavor and texture of Sparkle, Maine 55, and Monmouth were consistently more acceptable to 28 judges than Maine 54, Orland, and Howard 17.

**VITAMIN C CONTENT OF STRAWBERRIES.** E. F. Murphy, R. M. Bailey. The vitamin C content, per 100 grams of fresh fruit, was 45 mg. for Orland and Monmouth; 47 to 53 mg. for Howard 17, Maine 54, and Maine 55; and 70 mg. for Sparkle and Starbright.

After one year's storage the vitamin C content of frozen berries was only 14 to 26 mg. as compared with 32 to 45 mg. for the fresh fruit. This was a loss of 21 to 52 per cent of the original values.

Treatment of berries with low-methoxyl-pectin did not influence the ratings of the flavor or texture of six varieties of frozen berries.

## TOMATOES

**TOMATO VARIETY TRIALS AT HIGHMOOR FARM.** Lyle Littlefield. Twenty-four varieties were under observation at Highmoor as home and market garden types. Among the five highest early producers were four  $F_1$  hybrids, namely, Pritchard x Danmark, Pritchard x Sr. 28-43, Danmark x Sr. 28-43, and Early Hybrid. Other  $F_1$  hybrids were among the higher yielders and generally produced the more uniform fruit. Of the commercially available hybrids, Burpeeana Early Hybrid, Fordhook Hybrid, and Early Hybrid should be tested under local conditions.

**TOMATO VARIETY YIELDS AT ORONO AND PRESQUE ISLE.** E. F. Murphy, Reiner Bonde, J. H. Waring, Michael Goven. FNC and Quebec 5 were among the five highest early producers of 16 varieties tested in both locations. In Orono, Early Trellis, Pritchard x Danmark, and Bonney Best, and in Presque Isle, Early Chatham, FNC x Sioux, and Dixville were above average in early yield.

By September 15, Early Trellis and Quebec 5 were high producers in both areas. In addition, Bonny Best, Valiant, and Pritchard x Danmark were among the top five in Orono, while Early Chatham, FNC, and Abel were outstanding in Presque Isle.

**VITAMIN C OF MAINE TOMATOES.** E. F. Murphy. The vitamin C content per 100 grams of fresh tomato grown at Orono was 53 mg. for New Hampshire 50; 30 to 35 mg. for Early Trellis, FNC, High C, and Abel; and 20 to 28 mg. for Bonny Best, Dixville, Pritchard x Danmark, and Michigan 4502.

Detailed variety comparisons of vitamin content yields over a period of years have been published in Bulletin 489, "Tomatoes in Maine."

**EFFECT OF LIGHT ON TOMATO VITAMIN C.** E. F. Murphy. When fruits alone were covered with cellophane, there were no differences in the fruit vitamin C from exposed, colorless, and yellow cellophane-wrapped fruit. Fruits wrapped in cellophane of other colors had significantly lower vitamin C contents than those exposed or covered with transparent material.

When entire plants were enclosed, a 25 per cent reduction of total outdoor light did not affect the vitamin C of the fruit. When the light was decreased 38 per cent, the fruit vitamin C averaged 3 mg. less than fruit from exposed plants. All of the colored cellophanes caused 21 to 40 per cent decreases in vitamin C.

## VEGETABLE CROPS

**USE OF FERTILIZER PHOSPHORUS BY VEGETABLE CROPS.\*** P. N. Carpenter, G. L. Terman. Beans, corn, and tomatoes were grown in the greenhouse in two similar loam soils, except that one tested low in available phosphorus and the other medium high. Differential rates of none, 80 and 160 pounds of  $P_2O_5$  per acre were supplied as radioactive superphosphate; nitrogen and potash were supplied uniformly in adequate amounts.

The two soils produced similar growth and total phosphorus content of the crops at 3 sampling dates during their growth period. However, as shown by radioactive counts on the plant samples, the crops took a significantly higher proportion of their phosphorus from the fertilizer on the soil low in phosphorus than on the soil higher in phosphorus. These results are in agreement with the conclusions from work on potatoes and other crops, which took less phosphorus from the applied fertilizer as the residual phosphorus content of the soil increased.

## INSPECTION SERVICE

**INSPECTION SERVICE.** E. R. Tobey, B. E. Plummer, Jr., E. O. Merrill, D. J. Dubé, Judith M. Banton, E. S. Packard, J. S. Getchell, G. A. Waddell, C. A. Hayward. The Commissioner of Agriculture is the executive of the laws regulating the sale of fertilizers, agricultural seeds, insecticides, fungicides, foods, drugs, and feeding stuffs in Maine. It is the duty of the Director of the Maine Agricultural Experiment Station to analyze or cause to be analyzed the samples collected by the Commissioner and to publish the results of the analyses together with the names of the persons from whom the samples were obtained and

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\* Financial assistance was given this project by Fertilizer Industry Committee of Radioactive Tracer Elements.

such additional information as may seem advisable. This information is reported in the Official Inspections published during the year. The State Tax Assessor is the executive of the laws regulating the sale of gasoline and motor lubricants. It is the duty of the Director of the Station to analyze or cause to be analyzed the samples collected by the State Tax Assessor but no provision has been made for the publication of the results of the analyses.

A brief summary of the work of inspection is as follows:

**Testing of Dairy Glassware.** It is required by law that all Babcock glassware used in Maine by those buying or selling milk or cream on a basis of the butterfat content, must be tested for accuracy at the Maine Agricultural Experiment Station. A total of 1184 pieces have been examined during the past year. Three pieces were not passed.

**Fertilizer Inspection.** A total of 309 samples of fertilizer materials were collected and analyzed. Of these samples, 238 were mixed fertilizers containing nitrogen, phosphoric acid, potash, and in some of the samples, magnesium and borax. The samples of mixed fertilizers represented 178 different brands. Of the total number of samples received 40 were found to be below guaranty in total nitrogen, 47 in available phosphoric acid, 14 in total phosphoric acid, 28 in soluble potash, 1 in total potash, 6 in total magnesium, and 3 in total calcium. The results of inspection continue to show improvement in the quality of fertilizer sold in Maine as indicated by conformity to guaranties. The number of deficiencies as compared to the total number of samples decreased by fifteen per cent as compared to the previous year.

The results of the analyses are reported in Official Inspections 217.

**Fungicides and Insecticides Inspection.** A total of 137 official samples, including lead arsenate, mixtures containing arsenic and copper, fungicides containing copper, mixtures containing copper and DDT, insecticides containing DDT, mixtures containing DDT and zinc ethylene bis-dithiocarbamate, materials containing rotenone, copper and DDT, samples containing technical chlordane, and unclassified miscellaneous samples, were analyzed.

The analytical work in the inspection of fungicides and insecticides continues to increase each year. The greater popularity of the new organic materials and the use of these compounds in the manufacture of commercial products have produced many problems for the manufacturers and analysts. Yet the improvement in the quality of fungicides and insecticides sold in Maine is noted by the lower relative number of deficiencies in comparison to guaranties as compared to last year. This



decrease, based upon the total number of deficiencies as compared to the total number of samples, is approximately four per cent.

The results of the analyses are reported in Official Inspections 218.

**Commercial Agricultural Seeds Inspection.** One hundred seventy official seed samples were submitted for analysis to the Director of the Station in 1950. As the Station has no seed analyst on its staff, these samples were forwarded to the Iowa State College Seed Laboratory, Ames, Iowa, for analysis and the results were reported to the Station. These results of analyses are published in Official Inspections 218.

**Foods Inspection.** The number and variety of official samples collected and submitted depend upon the nature of the inspection work carried on by the Division of Inspection and the State Dairy Inspector, Augusta, Maine, in the enforcement of the food and dairy laws.

A total number of 5045 samples have been received and examined chemically, bacteriologically, or both. Included in this number are 3771 samples of milk and cream, 118 samples of bread, 192 samples of clams, 6 samples of hamburg, 5 samples of frozen custard, 35 samples of ice cream, 17 samples of ice cream mix, 159 samples of oil used in packing sardines and 742 miscellaneous samples. The majority of the miscellaneous samples, consisting of cooked meats, cream, flour, frozen dessert, ice cream, ice cream mix, milk, quahogs, starch, and vinegar were examined for municipal departments of health, dealers and private individuals.

The results of the inspection showed that approximately 16 per cent of the bread samples were unenriched, that sulfite is used as a preservative in hamburg by some dealers, that the majority of the ice cream samples complied with the standard, and that in many cases samples of shucked clams were not satisfactory on the basis of bacteriological examinations.

Continued improvement in the quality of milk and cream was shown by the results of analyses. Only 1 sample of milk was found to contain added water.

The results of the analyses will be reported in Official Inspections 219.

**Feeding Stuffs Inspection.** A total of 724 samples of feeding stuffs were received and the percentages of protein, fat and fiber in these samples were determined. The results of the inspection, as shown by the number of deficiencies in comparison with the guaranties, show that non-conformity to the guarantied analysis has increased by approximately five per cent over last year. The increase in the number of samples, which show a deficiency in fat, accounts for the most part for the increase in non-conformity to the guarantied analysis.

The results of the analyses will be reported in Official Inspections 220.

*Gasoline and Motor Lubricants Inspection.* A total of 780 samples of gasoline were received. The results of the analyses show that 13 of these samples did not comply with the specification of the Maine law regulating the sale of motor gasoline, namely, that the maximum temperature for complete distillation shall not exceed 437° F.

Four of the 46 samples of motor oils, which were examined, failed to meet the manufacturers' specifications for the respective brands asked for by the inspector.

## WEATHER

The winter of 1950 was generally mild and snowless. January and February temperatures were from 4 to 12 degrees above normal until the last 10 days when vigorous sub-zero temperatures and snow occurred. Precipitation was normal or slightly higher than normal. Real winter continued during two-thirds of March with the final 10 days bringing spring weather. Heavy precipitation on the 23rd to 24th helped to replenish water reservoirs. April precipitation was adequate to excessive with flood damages on the St. Croix River and some flood danger in southern Maine.

May was cool in most sections and precipitation was 1.5 to 3.0 inches below normal. The soil was dry enough for early planting, but too dry for seed germination in some areas. In spite of early planting, vegetation was 5 to 10 days late. Although the first part of June was favorable to vegetation, the middle period was abnormally cold with frost damage to tender vegetables in some areas. Rainfall continued deficient in southern Maine, but was excessive in the potato-growing areas. During July, water was extremely deficient in southern Maine, extending to the Penobscot River basin, retarding growth of hay, pastures, and other crops and causing domestic water shortages. Fire hazard again became serious, requiring constant vigilance. The potato section was favored with adequate precipitation. The drought was not relieved until the 19th to 20th of August, when rains fell over most of the area with enough penetration into the dry soil to save many of the seemingly doomed crops. Late summer vegetables were near normal in yield and quality.

Killing frost occurred in the north on September 13th and 14th and over most of the State on the 17th and 18th. The growing season ended 1 to 3 weeks earlier than usual. Dryness and warm weather characterized the latter part of September and all of October. November was warm, but 3 heavy storms raised the water levels. The storms on the

25th to 26th attained disastrous proportions with wind, tides, and floods causing widespread damage. December was abnormally warm, with heavy rains on the 7th to 8th and 9th to 12th, further increasing the water level to above normal.

The weather information obtained at the station farms in Jonesboro and Presque Isle, and by the Physics Department in Orono is published by the United States Weather Bureau in "Climatological Data for New England." The data for Highmoor Farm are summarized below.

Month	Temperature			Precipitation	
	Average	Max.	Min.	Total inches	No. of days with .01 inch or more
1950					
July	69.0	90	48	1.54	12
August	66.2	90	46	3.64	11
September	53.9	82	28	1.89	15
October	49.0	85	28	3.04	8
November	41.5	75	18	5.55	11
December	28.4	60	0	4.58	9
1951					
January	23.2	49	-16	1.36	13
February	24.2	51	-12	3.64	10
March	31.4	49	6	4.41	16
April	44.4	71	26	7.99	19
May	54.0	88	29	2.49	11
June	61.8	86	41	1.91	13

## PUBLICATIONS

The publications issued by the Experiment Station during 1950-51 included 8 Bulletins, 1 printed Miscellaneous Publication, 4 Official Inspections, and 9 Mimeographed Reports which were prepared for limited distribution.

One copy of any of the printed publications may be obtained, without charge, upon request to the Agricultural Experiment Station at Orono, Maine. A card listing the new available publications is mailed at least annually to those who request having their names placed on the mailing list for this purpose. A complete list of all bulletins now available also can be obtained upon request.

In addition to the publications issued by the Station Staff, a total of 12 articles were published during the year in scientific journals, 43 articles were included in agricultural magazines, and numerous news releases were printed in the newspapers. The research workers also have cooperated in preparing 10 publications issued by the Extension Service.

Members of the Station Staff have discussed the results of their research work at an increasingly large number of meetings. Research

papers were presented at 17 scientific meetings with a total attendance of 1615 scientists. Radio talks presenting research findings were given on 37 occasions to an unknown number of farm people. Other talks to farm groups given by research workers included 201 talks with a total attendance of over 13,000 people. Much research assistance also was given to a large number of farmers through personal correspondence and interviews in indentifying insects and diseases, and in recommending remedies for other current problems.

The following is a list of publications issued during 1950-51.

#### EXPERIMENT STATION BULLETINS:

- No. 484. Development of Defects in Potatoes between Shipping Points in Aroostook County, Maine, and Wholesale and Retail Markets in Boston, Massachusetts. Alvah L. Perry and Charles H. Merchant. September, 1950. 35 pages.
- No. 485. Effect of Potato Acreage Adjustments on Farm Practices in Aroostook County, Maine, 1948 and 1949. William E. Schrupf. September, 1950. 67 pages.
- No. 486. The Development of External Defects in Maine Potatoes at Retail Stores in Boston, Massachusetts, February and March, 1950. Roland J. A. Bouchard and A. L. Perry. November, 1950. 24 pages.
- No. 487. Potato Spindle Tuber Control. Reiner Bonde and Donald Merriam. February, 1951. 15 pages.
- No. 488. Pasture Improvement. C. H. Moran. February, 1951. 18 pages.
- No. 489. Tomatoes in Maine. Elizabeth F. Murphy and Mildred R. Covell. March, 1951. 70 pages.
- No. 490. Rate, Placement and Source of Nitrogen for Potatoes in Maine. G. L. Terman, Arthur Hawkins, C. E. Cunningham, and R. A. Struchtemeyer. April, 1951. 34 pages.
- + No. 491. Research on Maine Farm Problems, Sixty-Seventh Annual Report of Progress, Year Ending June 30, 1951. June, 1951. 80 pages.

#### OFFICIAL INSPECTIONS:

- No. 216. Commercial Feeding Stuffs, 1949-50. Elmer R. Tobey. July, 1950. 38 pages.
- No. 217. Commercial Fertilizers, 1950. Elmer R. Tobey. October, 1950. 32 pages.
- No. 218. Commercial Agricultural Seeds, 1950; Fungicides and Insecticides, 1950. Elmer R. Tobey. December, 1950. 37 pages.
- No. 219. Foods. Elmer R. Tobey. June, 1951. 43 pages.

#### MISCELLANEOUS PUBLICATIONS:

- No. 619. Maine Facts. Issued as Maine Agricultural Experiment Station Miscellaneous Publication No. 619 and Maine Agricultural Extension Service Extension Bulletin No. 412. June, 1951. 31 pages.

#### REGIONAL BULLETINS:

- Northeast Regional Publication 6, and Vt. Agr. Exp. Sta. Bul. 565. The State Milk Control Agencies in New England. Earl Warner. June, 1951. 80 pages.



Minn. Agr. Exp. Sta. Tech. Bul. 196, in cooperation with Maine and 10 other experiment stations and the U. S. Dept. Agr. Factors Influencing the Nutritive Value of Potatoes. June, 1951. 96 pages.

**MIMEOGRAPHED REPORTS: (for limited distribution by research departments) :**

- No. 12. Blueberry Disease Research By The Maine Agricultural Experiment Station. M. T. Hilborn. December, 1950. 6 pages.
- No. 13. Forage Crops Recommendations. Charles H. Moran. January, 1951. 9 pages.
- No. 14. 1950 Vegetable Variety Trials. Lyle Littlefield and Elizabeth Murphy. January, 1951. 12 pages.
- No. 15. A Guide For The Use Of Chemical Weed Killers. M. F. Trevett and C. E. Cunningham. February, 1951. 13 pages.
- No. 16. Cooperative Potato Variety Trials in 1950. S. C. Junkins, R. A. Struchtemeyer, and R. V. Akeley. February, 1951. 4 pages.
- No. 17. Cooperative Small Grain Trials In Maine—1950. S. C. Junkins. February, 1951. 3 pages.
- No. 18. Low Gallonage High Concentration Sprayer For The Control Of Potato Diseases and Insects. Reiner Bonde, F. W. Peikert, and R. B. Rhoads. March, 1951. 6 pages.
- No. 19. Changes In Costs Of Milk Distribution In Maine, 1949-1950. Homer B. Metzger. April, 1951. 7 pages.
- No. 20. Comparison of Tomato Varieties For Yield, Vitamin Content and Palatability. Elizabeth F. Murphy and Mildred R. Covell. May, 1951. 9 pages.

**ARTICLES IN SCIENTIFIC JOURNALS:**

- Bonde, Reiner and Donald Merriam. Studies on the Dissemination of the Potato Spindle Tuber Virus by Mechanical Inoculation. American Potato Journal, 28:558-560. 1951.
- Brugman, H. H. The Effect of the Plane of Nutrition on the Carcass Quality of a Line of Swine Based on a Chester White and Danish Landrace Cross. Journal Animal Sci., Vol. 9:602-607, November, 1950.
- Chandler, F. B. and M. E. Highlands. Blueberry Juice. Food Technology, Vol. 4, No. 7:285-286. 1950.
- Eggert, Franklin P. A Study of Rest in Several Varieties of Apple and in Other Fruit Species Grown in New York State. American Society Horticulture Sci. Proc. 58. 6 pages. 1951.
- Esselen, Jr., W. B., I. S. Fagerson, J. J. Licciardello. Heat Penetration in Glass Containers. Food Technology, Vol. 5, No. 6. 1951.
- Hilborn, M. T. Some Aspects of Apple Scab Control in Maine. Journal New Hampshire Horticulture Society. 13:43-50. 1950.
- Hilborn, M. T. and F. H. Lathrop. Organic Fungicides in the Control of Apple Scab and European Red Mite. Phytopath. 41:52-55. 1951.
- Lathrop, F. H. European Red Mite Control. Journal Econ. Entomology. 43:172-175. 1950.
- Lathrop, F. H. Sidelights on European Red Mite Control. Journal Econ. Entomology. (in press)
- Peikert, F. W. Mow Finishing of Hay. Agr. Institute Review, Agr. Institute of Canada. p. 49. September, 1950.

Terman, G. L., P. N. Carpenter, and S. C. Junkins. Nutrient Content of Potato Plants as Affected by Fertilizer Treatment and Other Factors. Soil Sci. Soc. American Proc. 14 (1949) :137-142. 1950.

Terman, G. L., Michael Goven, C. E. Cunningham. Effect of Storage Temperature and Size on French Fry Quality, Shrinkage and Specific Gravity of Maine Potatoes. American Potato Journal. 27 :417-424. 1950.

## FINANCIAL REPORT

The income of the Station during the year ending June 30, 1951 totaled \$475,462.56. The sources of income were 38.7 per cent from Federal funds, 23.6 per cent from State Appropriations, 16.0 per cent from the industry taxes on potatoes and blueberries, 12.5 per cent from service work on inspection analysis, Florida potato test, and soil testing, 2.5 per cent from special research grants, and 6.7 per cent primarily from the sale of farm products at the experimental farms.

The income received was \$7127 less than a year ago, and \$13,990 less than two years ago, which is a serious problem in view of increased costs of wages, supplies, and equipment. The decreased income during the past year was due primarily to a lower income from farm sales, and some decrease in potato and blueberry tax income.

### Summary of Income and Expenditures of The Maine Agricultural Experiment Station July 1, 1950 to June 30, 1951

Source of funds	Total income*	Per cent of income	Total expenses*
Hatch Act	\$ 15,000.00	3.2	\$ 15,000.00
Adams Act	15,000.00	3.2	15,000.00
Purnell Act	60,000.00	12.6	60,000.00
Bankhead-Jones Act	24,124.05	5.1	24,124.05
Research and Marketing Act	69,329.00	14.6	76,102.24
Total federal funds	\$183,453.05	38.7	\$190,226.29
State Mill Tax	\$112,360.61	23.6	\$112,360.61
Potato Tax	56,976.42	12.0	56,976.42
Blueberry Tax and Farm Sales	19,015.23	4.0	21,344.10
Inspection Analysis	29,770.14	6.2	29,770.14
Florida Potato Test	22,473.48	4.7	22,045.93
Soil Testing	7,862.51	1.6†	8,145.63
Sales and Service†	31,870.30	6.7	43,498.10
Special Research Grants‡	11,680.82	2.5	10,494.87
Total all funds	\$475,462.56	100.0	\$494,862.09

\* Does not include annual carry-over of funds.

† Includes income from farm products sold other than blueberries, and miscellaneous testing.

‡ Special research grants were received during the year from:

Sweet Corn Tax Receipts, through the Maine Department of Agriculture, for corn borer research.

Charles H. Hood Dairy Foundation for forage crop studies.

Fertilizer Industry Committee on Radioactive Tracer Elements for studies on utilization of phosphorus.

Maine Cannery Association for sweet corn breeding and processing studies.

General Chemical Company for potato spraying and dusting experiments.

Tennessee Corporation for potato fungicide tests.

Maine Development Commission for blueberry juice experiments.

Pennsylvania Industrial Chemical Corporation for insecticide tests.

General Chemical Division of Allied Chemical and Dye Corporation for chemical thinning of apples.